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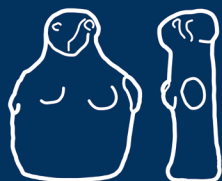
Aus dem Institut für Ur- und Frühgeschichte
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A Haunting Spectre

Archaeological Studies of Social Organisation,
Economic Practice, and Inequality

A Festschrift for Johannes Müller
on the occasion of his 65th birthday



2025

J. Kneisel, M. Furholt, R. Hofmann,
D. Mischka, W. Kirleis, M. Wunderlich (eds.)



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Economic Practice, and Inequality

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on the occasion of his 65th birthday**

Edited by **Jutta Kneisel, Martin Furholt, Robert Hofmann,
Doris Mischka, Wiebke Kirleis, Maria Wunderlich**

Volume 2



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CHAPTER 6 – CONTINUATION
Bridging the Scales



Figure chapter 6 (continuation): Idealised reconstruction of the landscape showing the changes from post-glacial tundra to a modern cultural landscape (Drawing: Susanne Beyer; graphic: Petra Horstmann).

Earth, Wood and Stone

The Earliest Monuments of Agrarian Societies in Southern Sweden

Lars Larsson

KEYWORDS: Earthen long barrow, façade, Early Neolithic, burial custom, Southern Sweden

Abstract

For a long time, the non-megalithic Early Neolithic earthen long barrow was not known in Sweden as a burial type, despite a large number of excavations of Early Neolithic settlement sites and the identification of a considerable number of non-megalithic earthen long barrows in nearby Denmark. The situation changed when a deliberate search resulted in evidence of two long barrows with east façades.

In recent years, a number of non-megalithic earthen long barrows have been identified by the presence of façades at sites during large-scale investigations after

topsoil removal. A number of excavations have shown that façades seem to be common, although in most cases without any traces of a barrow at all. In some cases, a number of façades have been identified without preserved graves. It may be questioned whether façades in most cases are directly related to long barrows. That they are nevertheless related to burial customs is indicated by a couple of finds of façades under dolmens. Façades made of erected stones instead of wooden posts have also been identified.

Zusammenfassung

Lange Zeit waren nichtmegalithische Langbetten in Schweden als Bestattungsform nicht bekannt, obwohl zahlreiche Ausgrabungen frühneolithischer Siedlungsplätze durchgeführt wurden und eine beträchtliche Anzahl von nichtmegalithische Langbetten im benachbarten Dänemark nachgewiesen wurde. Dies änderte sich, als bei einer gezielten Suche zwei Langgräber mit Ostfassade nachgewiesen werden konnten.

In den letzten Jahren wurde eine Reihe von nichtmegalithische Langbetten durch das Vorhandensein von Fassaden bei großflächigen Untersuchungen nach dem Abtragen des Oberbodens identifiziert. Eine Reihe von

Ausgrabungen zeigt, dass Fassaden häufig vorkommen, wobei in den meisten Fällen überhaupt keine Spuren einer Überhügelung sichtbar sind. Zudem konnte eine Reihe von Fassaden festgestellt werden, bei denen keine Gräber erhalten waren. In den meisten Fällen kann bezweifelt werden, ob ein kausaler Zusammenhang zwischen Fassaden und Langbetten besteht. Dass sie dennoch mit Bestattungssitten in Zusammenhang stehen, zeigen einige Fassadenbefunde unter Dolmen. Des Weiteren konnten Fassaden aus aufgerichteten Steinen anstelle von Holzpfosten nachgewiesen werden.

Abstrakt

Länge var tidigneolitiska långhögar inte påvisade i Sverige som en gravform trots ett flertal arkeologiska utgrävningar av tidigneolitiska boplatser och trots att ett betydande antal långhögar identifierats i närbelägna Danmark. Denna situation förändrades då en medveten sökning resulterade i två långhögar med östfasad identifierades. Under de senaste åren har ett antal långhögar påträffats genom belägg för fasader vid undersökningar

där matjorden borttagits inom stora ytor. Vid de flesta undersökningarna har det visat sig att fasadgröpar är vanliga men där spår efter högar saknas. Det kan därför ifrågasättas ifall fasader verkligen behöver relateras till höganläggningar. Att de verkligen är relaterade till gravskicket framgår av ett par tillfällen då fasadrännor påträffats under dösar. Fasadrännor som har gjort basen för resta stenar istället för trästolpar har också belagts.

INTRODUCTION

The earthen long barrow has for several decades been a well-known phenomenon in north-western Europe, especially as a result of excavations in Great Britain (Piggott 1967; Ashbee 1979). The earthen long barrow has become well established as an integrated part of the Early Neolithic agrarian societies in parts of northern continental Europe (Müller *et al.* 2014). In Denmark, the first long barrow was identified in the late 1930s when discussing the different types of Early Neolithic burials (Mathiassen 1936; Becker 1948; Madsen 1979; Kaul 1988). As a result of new excavations, the number of long barrows increased. In 2014 the number was estimated at 120 (Sørensen 2014, 192 table 29). The distribution was uneven, with the majority in western Denmark.

The identification in Denmark of several earthen long barrows, viewed as a typical element of Early Neolithic society in continental Europe, was not matched by similar progress in the southernmost part of Sweden. The material culture in southern Scandinavia displays prominent traits of the early agrarian societies, and so the failure to discover earthen long barrows, despite the considerable number of settlement sites, represented a discrepancy (Larsson 1984). The situation concerning graves was almost the same, as very few burials from this period were found in comparison to the increasing number of burials in Denmark (Larsson 2002a).

When studying the Danish earthen long barrows three basic elements should be considered — the barrow, the grave below the barrow, and the façade, that means a ditch with large wooden posts usually related to the easternmost part of the barrow. In some cases, the long barrows cover the remains of a façade that should be earlier than the barrow. In some barrows the façade is missing and a grave is missing (Sørensen 2014, 192 table 29). So, the temporality of barrow, grave and façade can be questioned.

Was the absence of earthen long barrows and graves in southernmost part of Sweden as a whole a prehistoric reality, or was it due to problems of identification in the course of excavations? One interesting observation is obvious, if we consider the kinds of prehistoric sites excavated in the 1970s and 1980s, when most excavation, as today, was connected with development. The number of sites with Stone Age remains was remarkably small in relation to sites with Iron Age finds (Larsson 2001). Subsequently, however, highly trained individuals with a special interest in Stone Age research joined the different excavation institutions at the national, municipal and private level. Within just a couple of years the excavated Neolithic sites became more numerous than the Iron Age sites. Interest in Stone Age features and awareness of them was increasing. Despite this remarkable change, no earthen long barrows were identified.

EARTHEN LONG BARROWS IN SOUTHERNMOST PART OF SWEDEN

This strange lack of monuments was the point of departure for seeking monuments that might be, or at least might initially have been, earthen long barrows. Here, attention was paid in particular to monuments that had been classified as long dolmens of extreme length, since a large number of Danish earthen long barrows were of considerable length (Rudebeck 2002b). There were a number of monuments of this kind. One of these was the long barrow Jättegraven (Giant's Grave), with a rather well-preserved kerb. It turned out to have a length of 64 m and a maximum width of 7 m in the easternmost part (Fig. 1). No obvious remains of a dolmen were visible (Larsson 1992, 2002c; Fig. 2A).

A common feature of the earthen long barrows in Denmark was the presence of a ditch for a façade in the easternmost part. Therefore, the initial excavation was aimed at opening up an area in the eastern part (Larsson 2002b). A façade was revealed by the soil discolorations of four post-holes in a ditch, found between the easternmost erected stones of the long side of the kerb. Some pottery sherds were found in association with stones at the top of the ditch of the façade.



Fig. 1. The distribution of long barrows/façades. A concentration in south-western Scania, southernmost Sweden, is significant, due to the fact that the area has been subject to extensive development (Graphic: Karin Winter).

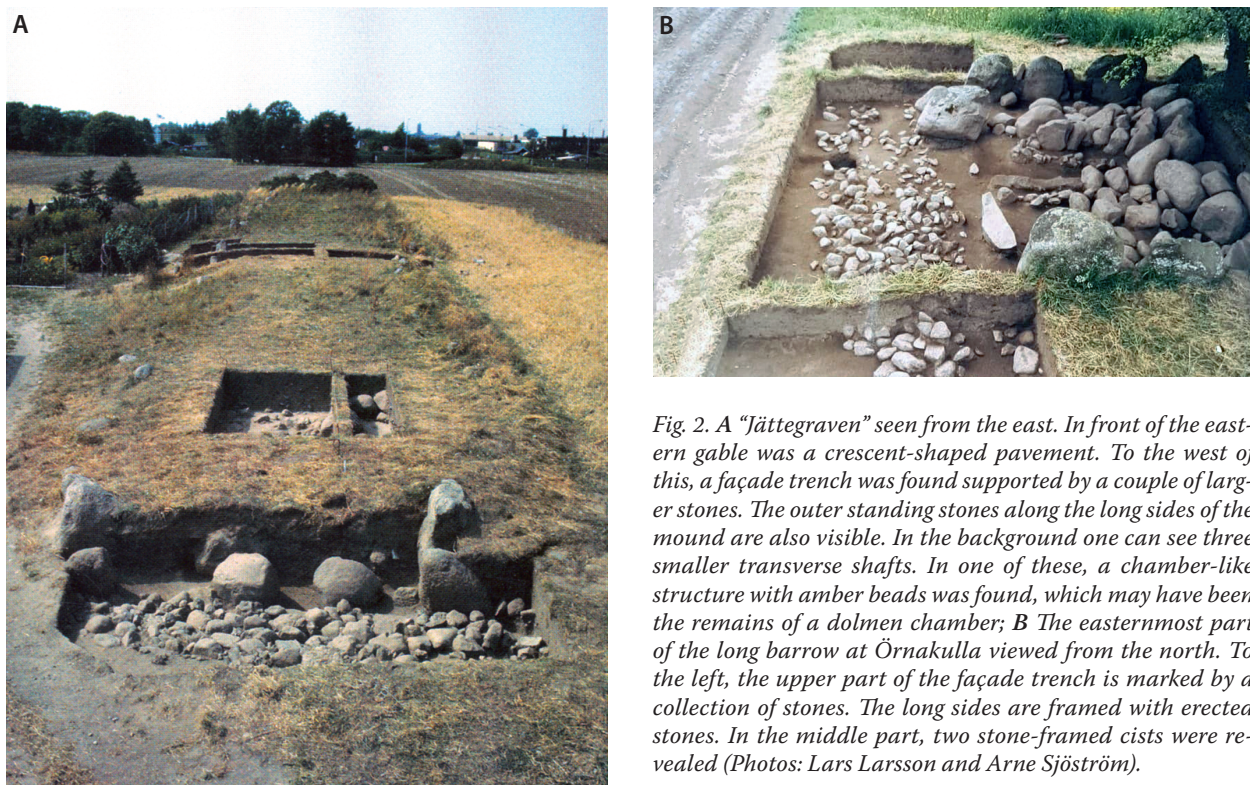


Fig. 2. A "Jättegraven" seen from the east. In front of the eastern gable was a crescent-shaped pavement. To the west of this, a façade trench was found supported by a couple of larger stones. The outer standing stones along the long sides of the mound are also visible. In the background one can see three smaller transverse shafts. In one of these, a chamber-like structure with amber beads was found, which may have been the remains of a dolmen chamber; B The easternmost part of the long barrow at Örnakulla viewed from the north. To the left, the upper part of the façade trench is marked by a collection of stones. The long sides are framed with erected stones. In the middle part, two stone-framed cists were revealed (Photos: Lars Larsson and Arne Sjöström).

These sherds had decoration in the Virum style. Oak charcoal was dated to 4223–3960 cal BC (Ua-2788, 1sigma; Table 1 and Fig. 3). The date is early, but the later part of the interval might be probable. The most conceivable explanation is that the few finds of

charcoal originate from the burning of the large posts in order to make them more resistant to decay. Judging from the size of the post-holes, they could have been at least 50 cm in diameter. They might have been centuries old when used for the façade.

Table 1. Radiocarbon dates of long barrows/façades in Scania.

Site	Lab no.	BP	cal BC (1 sigma)	cal BC (2 sigma)
Jättegraven	Ua-2788	5220 ± 70	4223–3960	4247–3810
Örnakulla	Ua-13606	5095 ± 180	4154–3654	4332–3529
Örnakulla	LuA-4419	4950 ± 140	3946–3635	4045–3377
Örnakulla	Ua-13607	4695 ± 80	3619–3372	3646–3192
Kristineberg	LuA-4541	5040 ± 110	3953–3711	4213–3543
Almhov	Ua-17158	4990 ± 70	3931–3655	3946–3649
Almhov	Ua-21333	4495 ± 45	3336–3102	3360–3028
Östra Odarslöv	LuS-11173	4835 ± 40	3650–3533	3702–3525
Östra Odarslöv	LuS-10923	4795 ± 45	3638–3529	3650–3382
Ljungaviken	Ua-30275	5212 ± 33	4045–3978	4219–3958
Ljungaviken	Ua-30272	5116 ± 33	3970–3810	3984–3799
Ljungaviken	Ua-30277	4967 ± 31	3776–3658	3894–3650
Vintri Park	Ua-28807	5130 ± 45	3984–3809	4042–3797
Vintrie Park	Ua-28808	4786 ± 45	3635–3529	3646–3381
Vintrie Park	Ua-43726	4816 ± 37	3646–3532	3648–3526
Truks Hoj	Ua-54854	4891 ± 29	3703–3640	3761–3633
Truls Hoj	LuS-12206	4826 ± 40	3647–3532	3700–3522
Truls Hoj	Ua-54855	4118 ± 28	2851–2624	2867–2677
Science Village	Ua-31947	4994 ± 39	3901–3660	3994–3652

OxCal v4.3.2 Bronk Ramsey (2017); r5 IntCal13 atmospheric curve Reimer et al. (2013)

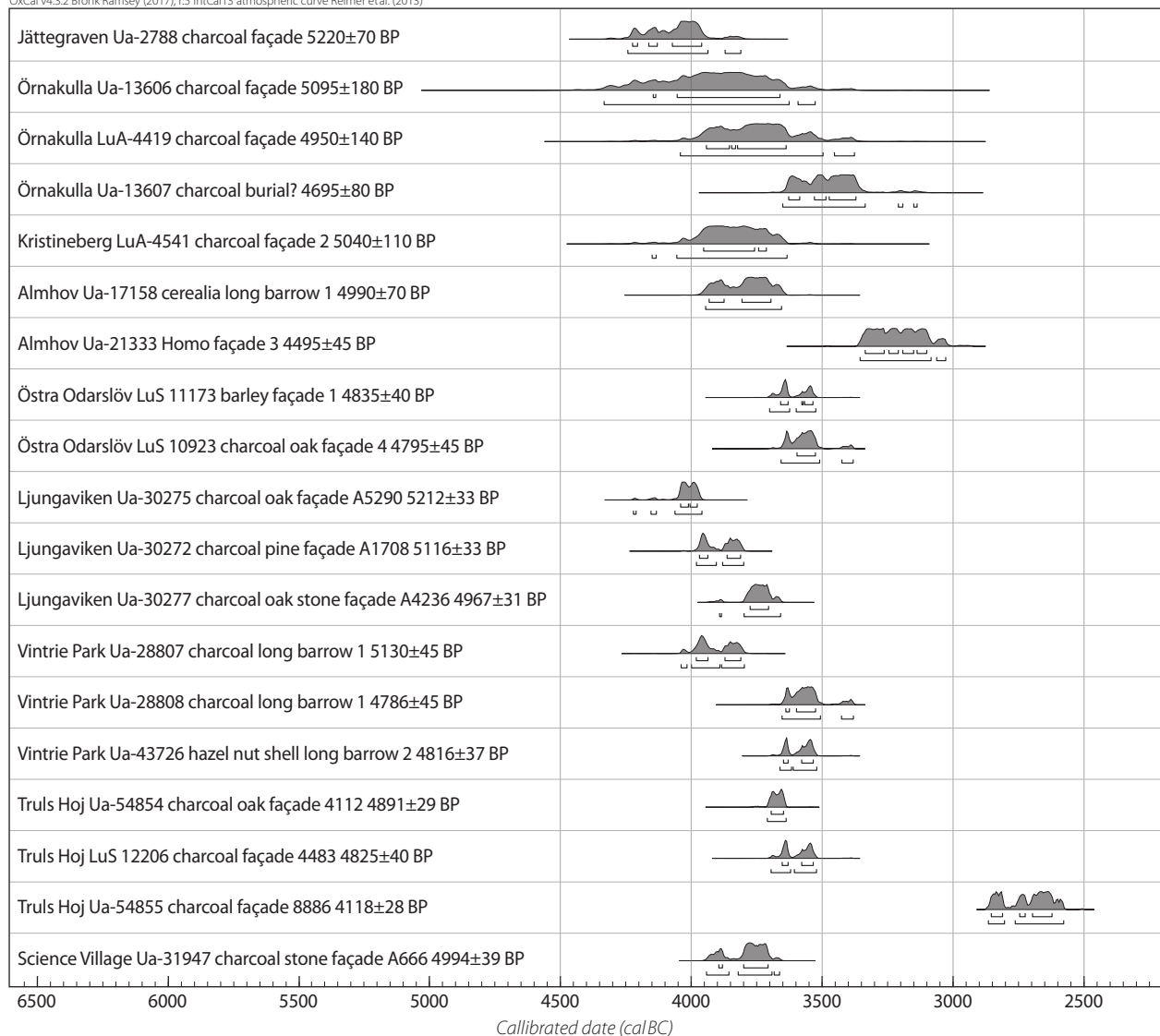


Fig. 3. Radiocarbon dates according to 1 sigma and 2 sigma.

Excavation in front of the façade revealed an almost D-shaped stone pavement with a small number of potsherds of the same kind as were found in association with the façade. This area might have been used for ceremonies in front of the façade.

Even though an area west of the façade was excavated, no securely identifiable grave was found. At a distance of 26 m west of the façade a large stone in two pieces was identified at the edge of the barrow. It corresponds in shape to the cover stone of a dolmen chamber. The area of the barrow adjacent to the large stone was excavated and standing stones were discovered. A couple of amber beads of Early Neolithic date, indicate the existence of a megalithic chamber.

Another monument, Örnakulla, classified as a long dolmen (see Fig. 1), was partly excavated as part of the

same project (Sjöström and Pihl 2002; Fig. 2B). With some stones missing from the western part of the kerb, the length is at least 60 m. The kerb reaches its greatest width, 6 m, in the eastern part. There is a dolmen still standing in the middle of the monument. A façade with postholes was identified in the excavation of the eastern part as well as two small chambers. A small number of potsherds are dated to the later part of the Early Neolithic. Two samples of charcoal from the façade provided the dates 4154–3654 cal BC (Ua-13606) and 3946–3635 cal BC (LuS-4419; Table 1). A sample from a small chamber, a possible grave, dates to 3619–3372 cal BC (Ua-13607; Table 1 and Fig. 3).

These excavations proved the existence of earthen long barrows with façades in the eastern part of southern Scandinavia. Already in 1977 features of

Early Neolithic date were excavated at Kristineberg in the town of Malmö (Rudebeck 2002a; Fig. 1). Interpretation based on analysis of the documentation and finds twenty years later indicates the initial existence of a settlement and thereafter two earthen long barrows, both with façades to the east. However, no barrows were identified. The occupation layer was dated by two samples from the food crust of three sherds, giving ages from 4223–3791 cal BC (5160 ± 130 BP, LuA-4544) to 3650–3379 cal BCE (4790 ± 100 BP, LuA-4543). One of

the long barrows does not include any traces of burial, while the second might have contained two burials or mortuary houses, as indicated by the traces of a wooden structure (Rudebeck 2002a). Charcoal from the façade has been dated to 3953–3711 cal BC (LuA-4541; see Table 1 and Fig. 3).

Since the long barrows in southern Sweden, just as in Denmark, are rather low, ploughing might easily have destroyed them. Long barrows without stone enclosures would have been even easier to destroy completely.

NEW FINDS OF LONG BARROWS/FAÇADES

Since the first earthen long barrows with façades were identified in Scania, a number of discoveries of the same kind have been recorded. All the newly discovered examples have come to light as a result of contract excavations. The distribution is very uneven, with a concentration in the south-western part of the county (Fig. 1). This is mainly due to the number of excavations performed where there has been intensive development of buildings and roads. With the topsoil removal of large areas, it became much easier to recognise both new kinds of features and the relationships between different traces of activities.

So far, a total of more than 30 earthen long barrows/façades have been identified (Andersson *et al.* 2016; Andersson 2017; Kjällquist and Kronberg 2014; Lindahl Jensen 2002). However, verification of the existence of a barrow might in most cases have to be regarded as very uncertain, as all of the long barrows were identified because of the façade. Where the length of the long barrow has been interpreted, it varies from about 11 m to more than 85 m. However, precise measurements are difficult to make, since all of them, with a few exceptions, have been destroyed by ploughing. Even the two examples first described, Jättegraven and Örnakulla, which had most of the kerb preserved, might have been extended through the addition of a megalithic chamber to the original structure.

During the large-scale excavation of Almhov, a site in south-western Scania (see Fig. 1), as many as four or perhaps even five façades were identified (Gidlöf *et al.* 2006; Gidlöf 2009; Rudebeck 2006, 2010; Fig. 4). Just one earthen long barrow was still recognisable, but in a stage of almost total destruction by ploughing. The other four façades could not be connected to any visible barrow. If they had existed at all they were located within a semicircle at a distance of about 50 m from each other.

Most of the pits for the façade are deep, with a number of stones surrounding the postholes. Just two of the façades have an associated grave, situated 3–5 m

from the façade, containing a small number of finds, most considered as secondary intrusive material (Gidlöf *et al.* 2006; Gidlöf 2009). The graves, either with skeletal remains or simply with stone packings without finds or skeletal remains, are situated just a couple of decimetres below the removed plough-zone.

A façade is dated to 3931–3655 cal BCE (Ua-17158) and a skeleton in the plausible long barrow 3 is dated to 3336–3102 cal BCE (Ua-21333; see Table 1 and 2).

These discoveries give rise to several different questions. Were all five façades connected to an earthen long barrow? Are the graves without skeletal remains or grave goods really graves? Are all the façades really façades of earthen long barrows, or do they represent something else? Did the function of façades change during their time of use? Are all features interpreted as façades really façades at all?

In most or all cases the temporal relationship between the earthen long barrow and façade might be questioned. The context of the activities relating to the earthen long barrow and the façade, and activities behind and in front of the façade might be called into question. Which is the earliest — the barrow or the façade?

One has to consider that we are dealing with two different materials. The façade was built of wood, and the barrow of earth. The “lifetime” of the former might have been a human generation, while barrows can still remain after thousands of years. The time duration must have been obvious to the builders.

The Almhov site presents a large number of features that should be related to the religious/ceremonial sphere (Artursson *et al.* 2016). Areas devoid of features to the east of the façades have been interpreted as arenas for some kind of ritual activity. The initial stage of the Early Neolithic at Almhov included a considerable number of double pits with a large number of finds (Gidlöf 2009; Rudebeck 2010). Judging by the type of pottery found and the radiocarbon dates, some are earlier than the earthen long barrows/façades, but a number could be contemporaneous.

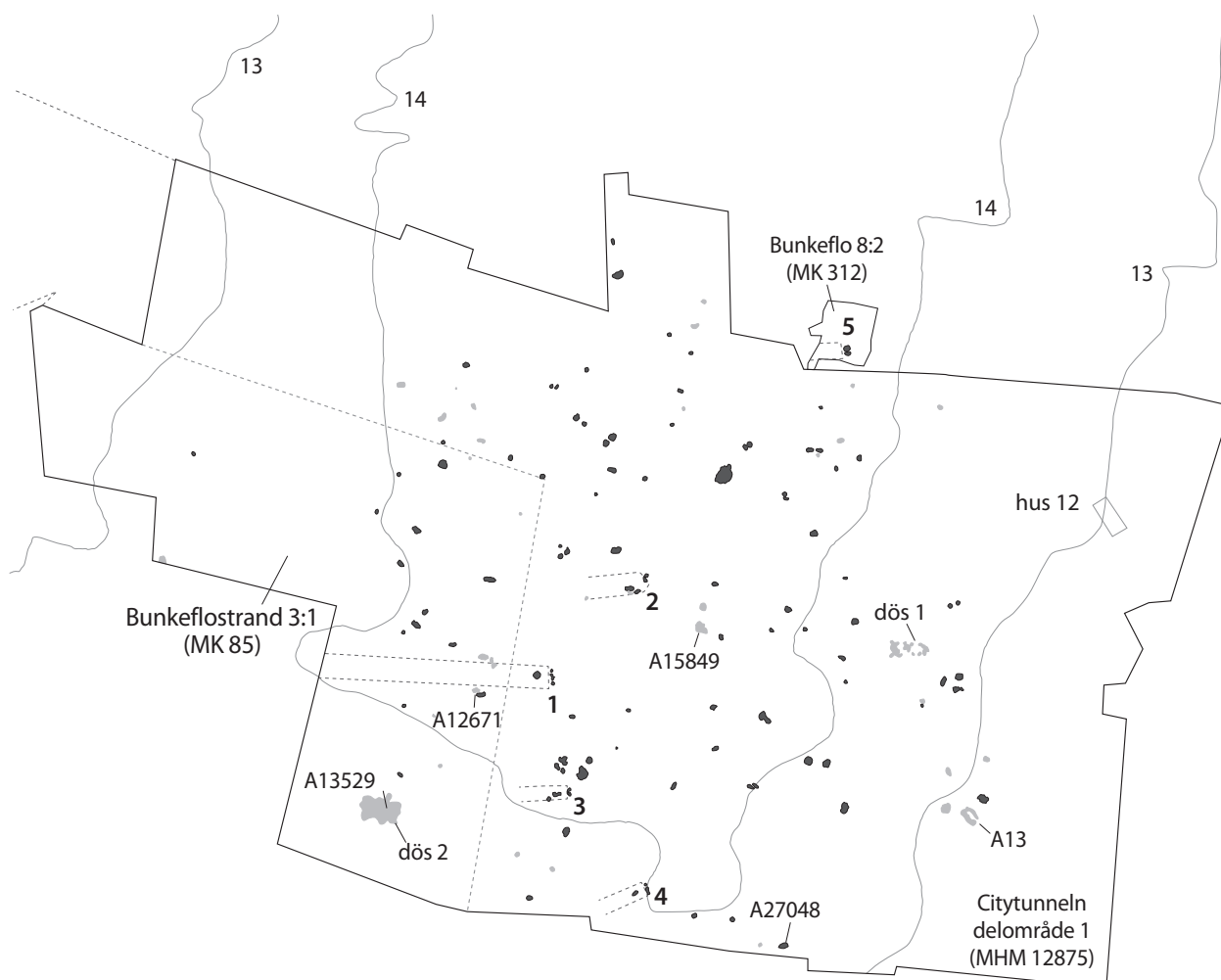


Fig. 4. Almhov, south-western Scania, with a number of features including four or five façades numbered 1–5. A long barrow (1) was still visible while the presence of barrows adjacent to the other façades is unclear (after Gidlöf 2009).

These double pits are not found on domestic sites but are present on a couple of other sites in association with long barrows/façades. The double pits have been interpreted as connected with ceremonial or religious activities. Another interpretation is that the finds are waste from a number of feasts (Rudebeck 2010).

At Jättegården and Örnakulla the façade is distinct, and the ditch is deep enough to support large wooden posts, in the former case as high as 3–4 m. The finds in the ditch of the façade in both monuments were limited to a small number of sherds. However, in some other cases the identified façades were shallower, with a depth between 0.6 and 0.3 m. Some contained a small number of finds, while others had a fill with numerous finds (Gidlöf 2009).

While the number of posts in the façade from Scania varies from two to eight, four is the most common number in façades in Scandinavia (Rudebeck 2002b). In three of the façades at Almhov two post-holes are larger than the other two, and the latter are somewhat displaced. Such a pair might be an example of the symbolic importance of pairs, often recorded in Early Neolithic in intentional depositions (Karsten 2000; Rudebeck 2010). Grinding stones, such as have been found in the façades, and the graves at Almhov are a very common phenomenon in Early Neolithic graves (Lidström Holmberg 1998).

We have no knowledge as to whether the posts were enhanced with some kind of carving or were topped by animal heads, for example. It has also been suggested that these posts constituted a platform to support the deceased (Noble 2006).

DOLMENS ON FAÇADE TRENCHES AND FAÇADES WITH STONES

At Almhov there was a strange feature directly related spatially to one of the two identified megalithic dolmens. This is a ditch filled with stones below the western part of the dolmen, interpreted as a kind of façade with two or four posts (Rudebeck 2010). Remains of a red deer, some flints and pottery had been deposited on the packing.

The excavation at Östra Odarslöv, in the south-western part of Scania (Fig. 1), covered an area of 38,000 m² (Fig. 5). A considerable number of features dated to the Early Neolithic were excavated (Andersson and Artursson 2017). Among the features within this area five façades and three dolmens were identified (Andersson and Artursson 2017; Brink 2017).

One façade was found below the western part of the faint remains of a dolmen and another in the central part of a second dolmen (Fig. 5). A stone packing and a pit close to the former have been regarded as grave, despite no existence of skeletal remains or grave goods. However, no remains of a long barrows were identified.

In Östra Odarslöv yet another façade was found directly below a megalithic tomb. Excavations of megalithic tombs, even those where all the stones have been removed, are normally terminated at the base of the floor. It is only when there is the possibility, the effort and the interest to continue the documentation by excavating deeper that façades below a megalith can be found.

The dates indicate that there is a time span of at least 200 years between the erection of the façades and the building of the megalithic tombs. As at Almhov, the close spatial relationship between façades and later megaliths is of special interest. It is questionable whether anything would have remained of the façade after such an interval, but the memory of its existence might still have been present. In these instances, the dolmen was positioned directly on top of the façade, while in other cases, such as Örnakulla and probably Jättegraven, the dolmen was erected in the same monument but at a distance from the façade.

At Östra Odarslöv a couple of façades were found in the same part of the excavated area where a number of huts were revealed (Schultz Paulsson *et al.* 2017; Fig. 5). This indicates that this type of structure might in certain cases, as with finds in Denmark, have had some kind of connection with settlement sites (Sørensen 2014, 192 table 29).

Yet another feature at Östra Odarslöv has been included among the façades. It consists of shallow pits from a total of five erected stones, with the largest in the middle. This interpretation indicates another kind of façade with erected stones instead of wooden posts.

This façade is dated to 3650–3533 cal BC (LuS-11173; see Table 1 and Fig. 3). It is located just a few metres from the short side of the kerb of a dolmen. This kind of façade of permanent material could have been visible when the megalithic tomb was built.

Another excavation area provides support for the idea that façades could have been constructed with erected stones. During the excavation at Ljungaviken, in the westernmost part of Blekinge (Fig. 1), some 200 km to the north-east of the sites mentioned above, a ditch, 5.6 m long, with five erected stones was identified. The imprints of the stones varied between 0.6 m and 1.2 m in diameter within an area of Early Neolithic settlement (Kjällquist and Kronberg 2014). The size of the imprints indicates a stone structure of considerable size. The features yielded a number of artefacts, mainly of flint, and were dated to 3970–3810 cal BC (Ua-30272; Table 1 and Fig. 3). At the same site a row of nine closely spaced post-holes within a distance of 3 m has been considered as a variety of a façade. However, with one exception the post-holes are shallow, varying between 10 cm and 20 cm. Charcoal from this structure was dated to 4045–3978 cal BC (Ua-30275; Table 1 and Fig. 3), an extremely early date for a façade.

At Vintrie Park, southwestern part of Scania (Fig. 1) at least one façade was identified. Some 12 m west of the façade, a stone packing might mark a grave, but no remains of a human skeleton or grave goods were found (Brink and Hammarstrand Dehman 2013). There were few finds in the post-holes. There is a further feature that might be a façade. A considerable number of finds were recovered. The façades are dated to 3984–3809 cal BC (Ua-28807), 3646–3532 cal BC (Ua-43726) and 3635–3529 cal BC (Ua-28808; Table 1 and Fig. 3).

At Truls Hoj (Truls's Mound), close to the shore of western Scania, altogether four façades and a passage grave were excavated (Andersson 2017; Fig. 1). Few artefacts were found in the ditches dug for two façades that had supported wooden posts. By contrast, considerable amounts of flint artefacts, as much as 7 kg, were associated with two façades built with two standing stones each. They are dated to 3708–3640 cal BC (Ua-54854; Table 1 and Fig. 3). One of façades with posts was dated to 2851–2624 cal BC (Ua-54855; Table 1 and Fig. 3). No remains of long barrows were identified.

At Science Village, southwest Scania (Fig. 1), which also includes a very extensive area where topsoil removal was carried out, three features were identified as façades in close proximity to traces of megalithic tombs (Kronberg 2015). All have traces of erected stones and one of these is dated to 3901–3660 cal BC (Ua-31947; Table 1 and Fig. 3).

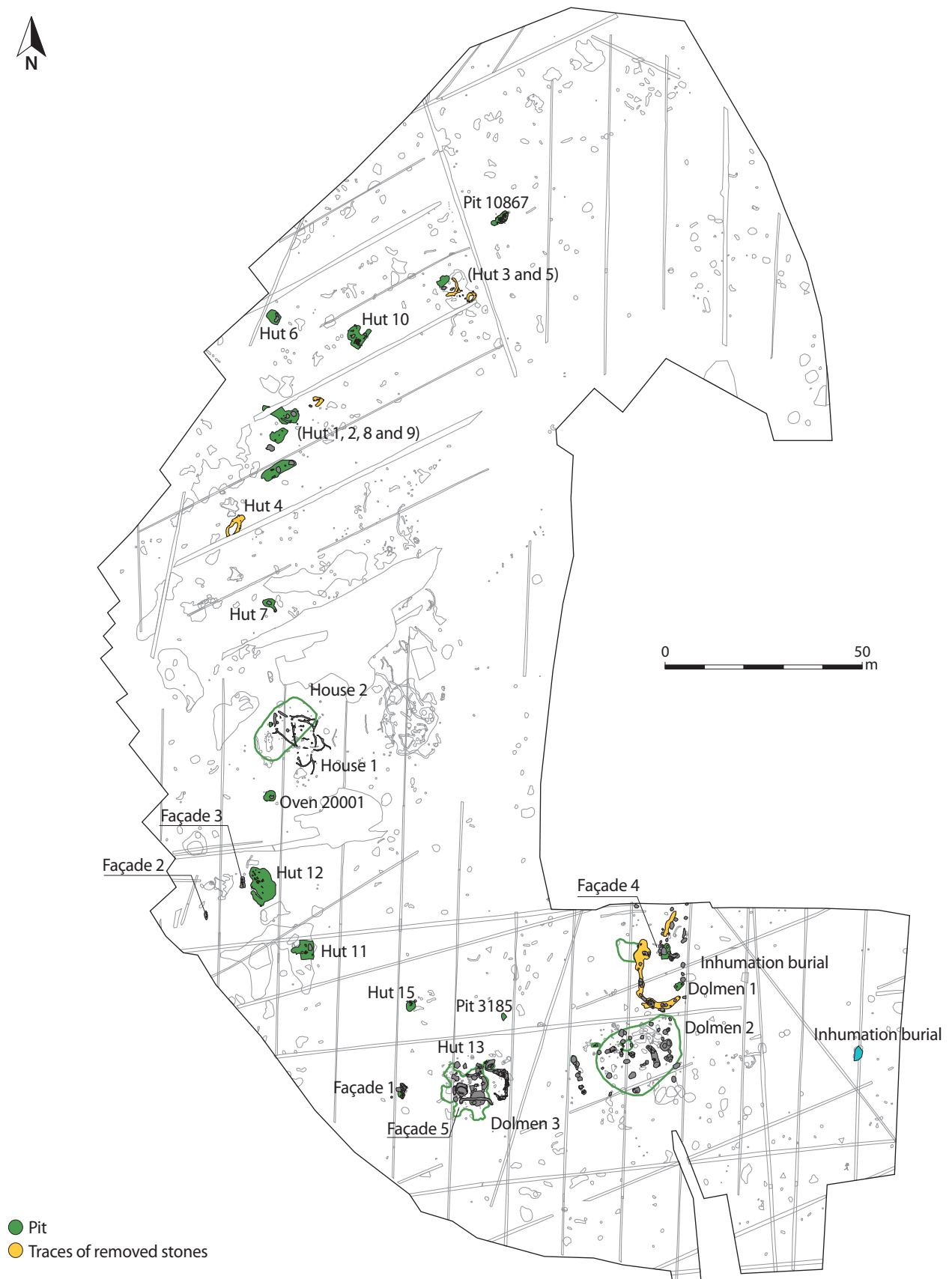


Fig. 5. Östra Odarslöv, south-western Scania, a large excavation area with settlement features, façades and dolmens (after Andersson and Artursson 2017).

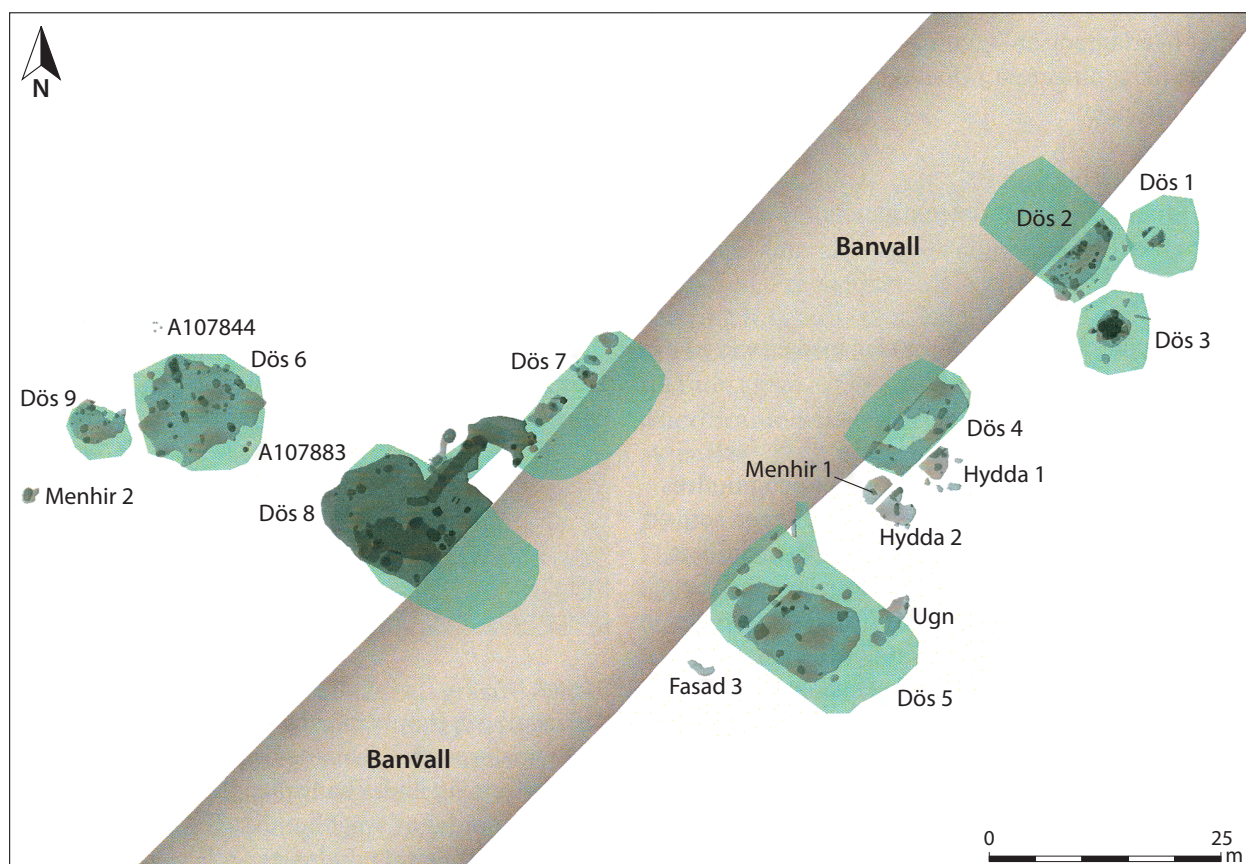


Fig. 6. Flackarp with excavations on both sides of an existing railway embankment (*banvall*) with traces of huts (*hydda*), dolmens (*dös*) and façades (*fasad*) (after Andersson *et al.* 2021).

Another indication that façades are not connected to long mounds can be found in the investigation of the excavation area on both sides of a railway track at Flackarp, south-western Scania (Andersson *et al.* 2021). Nine dolmens were identified through traces of stone removal and four façades within a distance of only 120 metres (Fig. 6). A façade consisting of three stones was found right beside a dolmen. Of the other

structures that have been interpreted as façades, two have traces of stone removal.

Concerning façades erected with stones, there might be a certain relationship with early megalithic monuments in France with alignments of stones including a number of standing stones (Laporte and Tinévez 2004; Laporte *et al.* 2017).

THE IDENTIFICATION OF LONG BARROWS/FAÇADES

We have to take into consideration that new excavations have improved the capacity for identifying features that have not been discovered before. The new situation, with the identification of about 30 megaliths as at Håslöv where all the stones have been removed, leaving just the shallow pits marking the imprint of standing stones, has made some archaeologists expert in identifying even the slightest imprint of erected stones (Andersson and Wallebom 2013). In earlier excavation such imprints might have been overlooked.

Based on the Scanian excavation results there are strong indications that façades are not always connected with earthen long barrows. Even if such monuments could have been destroyed, there are examples where at least minor remains should be identifiable. Façades could also be spatially but not chronologically related to megalithic tombs.

Another finding is that façades could be built either of posts or standing stones. There is a difference in terms of the finds associated with the façades. In most

of the façades supported by wooden posts the number of artefacts is low. In contrast, there are more finds, especially of flint, at façades constructed with stones. There might be a difference in terms of chronology, indicating that the façades made of stones are somewhat later. But according to the dates the stone façades

are as early as those with posts. Perhaps the transition from wood to stone can be viewed as marking an intermediate stage from the soil and wood of the façades and earthen long barrows to megalithic tombs. In that case the stone façades mark the first real megalithic construction in southern Scandinavia!

FAÇADES/LONG BARROWS IN THE SOCIAL SETTING

The number of façades/long barrows has increased considerably during the last few years. But this is based solely on the new large-scale excavations occasioned by development. There might have been hundreds of monuments covering partly the eastern, southern and western coastline corridor equal to the distribution of the later megalithic tombs. Until the late 1990s about 100 megaliths were known in Scania (Malmer 2003). So far about 40 totally destroyed tombs have been identified by new excavations. The evidence of these new excavations suggests that it would be realistic to estimate that about 90% of all tombs have been destroyed since the Neolithic.

The relationship between the long barrow and settlement sites is unclear in most cases. Some kind of Early Neolithic settlement seems to have existed before the Jättegraven long barrow was built, partly covered by the barrow (Larsson 2002a). Traces of early Neolithic settlement have also been found directly adjacent to façades from other sites.

In view of the fact that long mounds have been built over settlement remains and graves, a form of burial monument appears to be linked to a marker of individual character, the burial, as well as a more collective expression, the house.

There is a major difference in the depth of the façades. In one instance in Denmark the trenches for façades are cut to a depth of 2.5 m (Andersen 2015, 125). However, there are Scanian examples where the posts have been erected in pits or ditches not more than 0.3 m in depth. Even if the topsoil was removed when the façades were identified, having been stabilised by stones, the length of the posts can not have been longer than a couple of metres. In the deeper ditches the posts could have had a length of 4–5 m. A post like this would have weighed at least two tons, comparable to the small orthostats in the early dolmens. This might also equal to the standing stones in some of the façades that were built with stones.

The façades with standing stones are thus the earliest example of megalithic architecture in southern Scandinavia, preceding the earliest dolmen by about two centuries. The façades with posts must have decayed, been removed or burnt down within a generation or two. However, the façades made of erected

stones could still have been standing when the first megalithic tombs were built. Either they were used as building material in the dolmen or were in some way incorporated in the environment at the megalithic structure. On one of the sites, Östra Odarslöv, the location of the stone façade indicates that it might have been integrated with the megalithic tomb as a row of stones in front of the east short side of the kerb of the dolmen (Andersson and Artursson 2017).

As it has been proved, in at least two sites, the location of façades below a megalithic tomb does not seem to be a random circumstance. The façades had disappeared but the exact location was still known in the community. The combination of one kind of monument with a new one made the continuation of traditions and conceptions even more firmly established, although the use might have changed.

The construction of earthen long barrows, even the long ones, should not have been that complicated with the aid of neighbouring groups. But in some instances this work was made more difficult as the soil was not taken from around the barrow but from a distance of at least a hundred metres, as proved by the first excavated long barrow of Jättegraven (Regnell 2002).

As for the age of the façades, they all are dated to the phase 3.800–3500 cal BC. With 2 sigma it is difficult to single out a façade being earlier than another (Table 1). The locality or stratigraphy of the features on one and the same site do not provide any reliable base for discerning one as older than another. An interesting observation is that the façades with stones are as early as those with posts.

As a phenomenon, long barrows appear at the same time in northern part of the continent (Sørensen 2014), so they do not belong to the package of agricultural ingredients in the oldest farming society. There seems to have been an interval of a couple of centuries before the agrarian social system was significantly established (Johansen 2023). With the development of an agrarian economy, there was acceptance of the need to start erecting monumental structures.

In view of the heavy soil preparation that has been carried out in recent centuries, there is reason to assume that façades may have been erected independently of both burial sites and graves. The

knowledge of how the wooden façade was designed above ground may have included a platform where a deceased member of society was placed. In the case of

stone façades, this interpretation is less likely. Compared to stone façades, they had a relatively short existence, at most equivalent to a human life.

FINAL COMMENTS

Just a couple of hundred years preceding the introduction of agriculture, societies start to build earthen long barrows related to large façades of either wood or stone. In most but not all cases they are related to one or two graves. In most examples the grave goods are absent or limited to artefacts that are not at all exceptional in design or made of exotic material, such as would indicate goods reserved for a social elite (Nielsen and Sørensen 2019). Still, the erection of the earthen long barrow and the façade involved considerable effort, justified by a special event. The long barrow/façade itself might have been the most important grave good for the deceased.

The well-preserved earthen long barrows are all low with a maximum height of about one metre. If they were not surrounded by a kerb, they might have been easy to destroy by ploughing. If they were surrounded by a kerb and removed, some of the imprints should be as easy to recognise as the imprint in stone façades and the kerb of megalithic tombs. There are several examples of the latter.

Even a ploughed-out long barrow would in some instances be possible to identify by a small rise of the surface. But then a precise measurement of the surface

would need to be surveyed before the excavation. This is something to take in account in the future before excavations are undertaken on sites where Early Neolithic remains are known to exist or may be expected.

We have to accept that façades were not entirely linked to earthen long barrows but could have been built independently. The same seems to be the case with the relationship between façades and graves. Even if some of the stone packings interpreted as graves might not be graves, there is a clear relationship between these and façades. But the causality might be uncertain in some instances and in others totally absent.

Façades could be related to ritual or even mortuary practice even if they do not need to be directly associated with burials. One reason could be the connections of some façades to later megalithic tombs. On the other hand, erected tree trunks or stones, metaphors for phal-luses, resemble symbols in a fertility cult. Death and life interacted in the same monument.

As for the choice of material, there would not have been any noticeable difference in the weight or the effort needed to handle between a big post a few metres long and a stone probably only two metres at the most.

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Einzelknochen in eisenzeitlichen Fundplätzen West- und Mitteleuropas

Eine Musteranalyse mittels Korrespondenzanalyse und vorgeschalteter bayesscher Modellierung

Nils Müller-Schneeßel

KEYWORDS: *correspondence analysis, Bayesian modelling, Iron Age, Central Europe, single bones*

Zusammenfassung

Dieser Beitrag untersucht die Behandlung menschlicher Überreste in eisenzeitlichen Siedlungen, Heiligtümern und Oppida mittels Korrespondenzanalyse und einem vorgeschalteten bayesschen log-linearen Modell. Die Imputation fehlender Werte ermöglicht die gleichzeitige Analyse von Datensätzen, die ansonsten schwer miteinander vergleichbar gewesen wären. Das Modell und die anschließende Korrespondenzanalyse zeigt die selektive Deponierung von Schädelknochen in Siedlungen und postkranialen Knochen in Heiligtümern und

Oppida. Die Korrespondenzanalyse trennt dabei auf der ersten Achse nach Robustizität der Knochen, jedoch in weiteren Dimensionen auch nach unterschiedlichen Selektionsmechanismen. Die Verwendung von Kreditabilitätsellipsen ermöglicht eine differenzierte Darstellung und hilft, signifikante von weniger signifikanten Mustern zu trennen. Zukünftige Forschungen sollten sich vermehrt mit der Untersuchung der Knochen selbst befassen, wofür insbesondere naturwissenschaftliche Methoden in Betracht kommen.

Abstract

This paper analyses the treatment of human remains in Iron Age settlements, sanctuaries and oppida using correspondence analysis together with a Bayesian log-linear model. The imputation of missing values enables the simultaneous analysis of data sets that would otherwise have been difficult to compare. The model and the subsequent correspondence analysis show the selective deposition of cranial bones in settlements and post-cranial bones in sanctuaries and oppida. The

correspondence analysis separates on the first axis according to the robustness of the bones, but in further dimensions also according to different selection mechanisms. The use of credibility ellipses enables a differentiated visualisation and helps to separate significant from less significant patterns. Future research should focus more on the study of the bones themselves, using scientific methods in particular.

EINLEITUNG

Einzelne menschliche Knochen in Siedlungskontexten kommen in zahlreichen urgeschichtlichen Epochen regelhaft vor. Während der Eisenzeit Mitteleuropas scheint dieses Phänomen aber gehäuft aufzutreten, wobei die Fundkontexte teilweise sehr unterschiedlich sind. Die Analyse der Verteilung von Einzelknochen hat durchaus eine gewisse Tradition, um etwa der Frage „*Cult or Conflict?*“ (Lux 1994) näher zu kommen. Allerdings beschränken sich derartige Untersuchungen meist auf die Betrachtung prozentualer Anteile (Jud 2008).

Eine Clusteranalyse wurde durch Peter Caselitz und Wolfgang Schlüter (Caselitz und Schlüter 2013) vorgenommen. Im Gegensatz dazu wird in diesem Beitrag mit Hilfe der Korrespondenzanalyse, die im methodologischen Werkzeugkasten des Jubilars immer eine herausragende Rolle gespielt hat (z.B. Müller 1994; 2001; Müller *et al.* 1997), das Auftreten einzelner menschlicher Knochen nach wiederkehrenden Mustern analysiert, um sich so der Deutung dieses vielschichtigen Phänomens anzunähern.

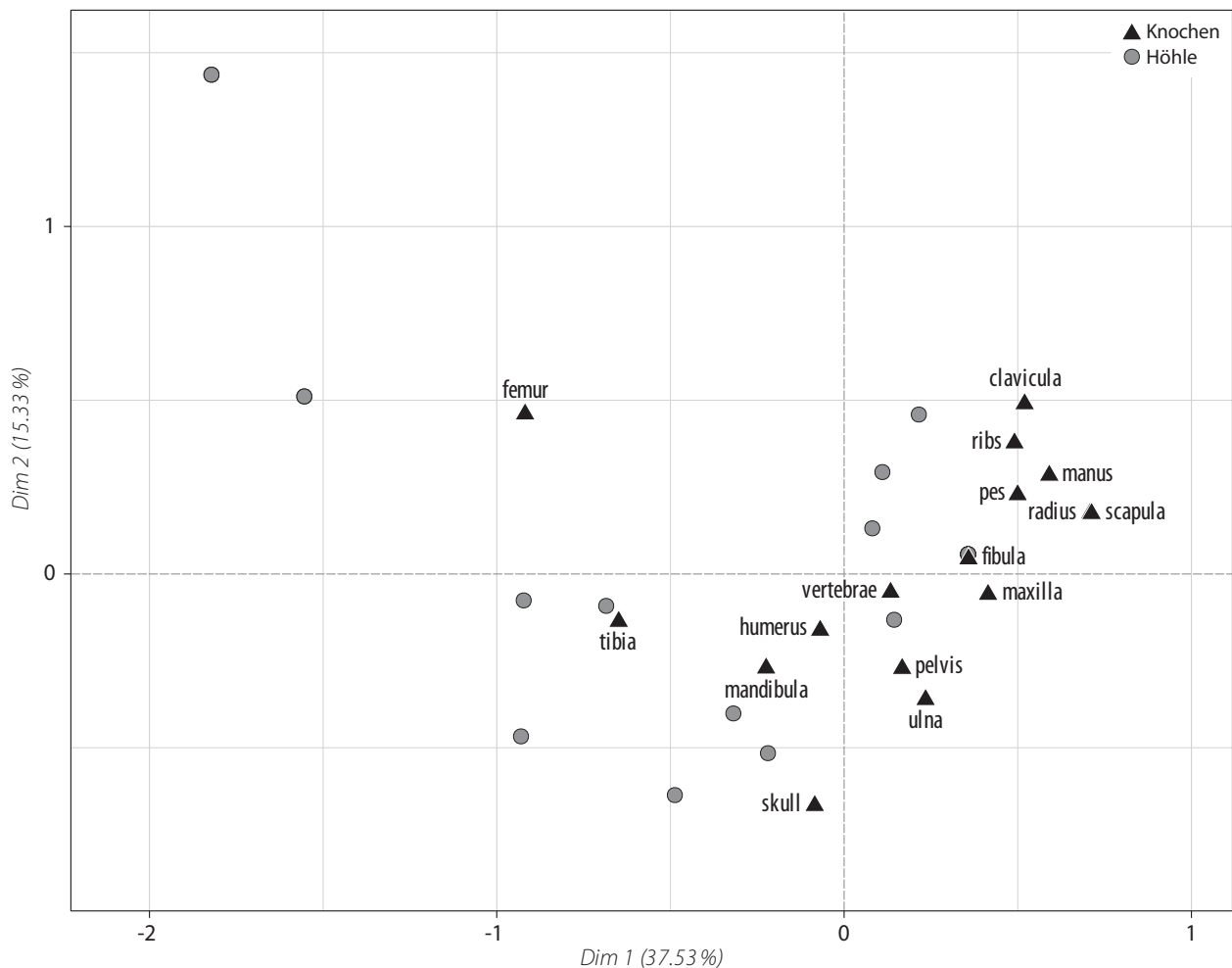


Abb. 1. Ordinationsdiagramm einer Korrespondenzanalyse der An- und Abwesenheit von Knochen (Dreiecke) in Höhlen (Kreise) der Sierra Madre/Nordmexiko (Daten nach Pastron und Clewlow 1974, 180 Tabelle 1).

Leider erlaubt die Korrespondenzanalyse keine fehlenden Daten, was bei der unterschiedlichen Aufbereitung der Daten ein Problem darstellt, wie unten zu zeigen sein wird. Außerdem gestatten die Ordinationsdiagramme der Korrespondenzanalyse zwar einen intuitiven Einblick in die Zusammenhänge zwischen den Daten, geben aber keine Anhaltspunkte zur Zuverlässigkeit der dargestellten Zusammenhänge. Hier setzt der vorliegende Beitrag an, indem er eine Korrespondenzanalyse mit bayesscher Modellierung mittels Markow-Chain-Monte-Carlo-Simulationen kombiniert. Für sowohl die Ergänzung fehlender Werte wie auch die Darstellung der Unsicherheiten bei der Korrespondenzanalyse kann direkt auf die simulierten posterioren Verteilungen zurückgegriffen werden. Diese doppelte Verwendung der MCMC-Simulationen stellt m. E. einen entscheidenden Vorteil gegenüber der frequentistischen Vorgehensweise mittels Bootstrapping (Ringrose 1992; 2012) dar. Diese ermöglicht lediglich eine Berücksichtigung der Unsicherheiten.

Zahlreiche Studien zeigen, dass nicht alle Knochen dieselbe Überlieferungschance haben; in der Regel korreliert die Wahrscheinlichkeit, mit der ein Knochen der vollkommenen Zerstörung entgeht bzw. geborgen wird, mit der Massivität dieses Knochens (Mays 1998, 14–24).

Sehr eindrücklich zeigt sich dieser Sachverhalt in einer Studie (Pastron und Clewlow 1974), in der die in einem ethnoarchäologischen Kontext in Nordmexiko noch vorhandenen Knochenelemente aufsummiert wurden. In einer Korrespondenzanalyse der An- und Abwesenheit einzelner Knochen ist deutlich sichtbar, dass sich entlang der ersten Achse Knochen mit einer guten Erhaltungschance — insbesondere Femur und Tibia — und solche einer schlechten — vor allem Hand- und Fußknochen, Rippen, Schlüsselbein, Radius und Schulterblatt — gegenüberstehen (Abb. 1). Die erste Dimension wird also durch die natürlichen Erhaltungsbedingungen bestimmt.

Weniger eindeutig ist die Interpretation der zweiten Achse. Im negativen Bereich scheint der Schädel (ohne

Maxilla und Mandibula) von den anderen Skelettelementen abgesetzt. In den Rohdaten äußert sich dies darin, dass Schädel seltener als Unterkiefer nachgewiesen wurden. Unter Berücksichtigung dieses Umstandes liegt die Interpretation nahe, dass der Hirnschädel nicht einfach vergangen ist, sondern aktiv entnommen wurde. Auf der zweiten Achse würde sich — entgegen der Ansicht der Autoren (Pastron und Clewlow 1974, 179) — dementsprechend menschliche Einflussnahme,

mutmaßlich in der Form von Grabräubern, äußern.

Die Korrespondenzanalyse ist also grundsätzlich in der Lage, bei der Zusammensetzung der menschlichen Skelettelemente zwischen natürlichen Dekompositionsvorgängen und menschlicher Einflussnahme zu differenzieren. Im Folgenden wird geprüft, inwiefern sich ähnliche Unterschiede auch bei eisenzeitlichen Fundplätzen herausarbeiten lassen.

DATENBASIS

In der folgenden Analyse sind Fundplätze enthalten, die von der Urnenfelderzeit bis an das Ende der Latènezeit datieren. Geographisch umfassen sie Nordwest-, West- und Mitteleuropa. Neben der räumlichen und zeitlichen Komponente war für die Aufnahme vor allem das Vorliegen einer größeren Anzahl menschlicher einzelner Knochen zentral. In der Regel setzt dies eine Analyse der Tierknochen eines Fundplatzes voraus, da viele menschliche Knochen erst bei der

Begutachtung aller Knochen, also auch der mutmaßlich von Tieren stammenden, als solche identifiziert werden. Teilweise sind auch mehrere Fundplätze einer Region zusammengefasst, da die einzelnen Fundplätze zu wenige Knochen für eine sinnvolle Einbeziehung erbracht haben. Die Zusammenstellung erhebt keineswegs den Anspruch auf Vollständigkeit, sollte jedoch bedeutende und aussagekräftige Fundplätze umfassen (Abb. 2; Tabelle 1).

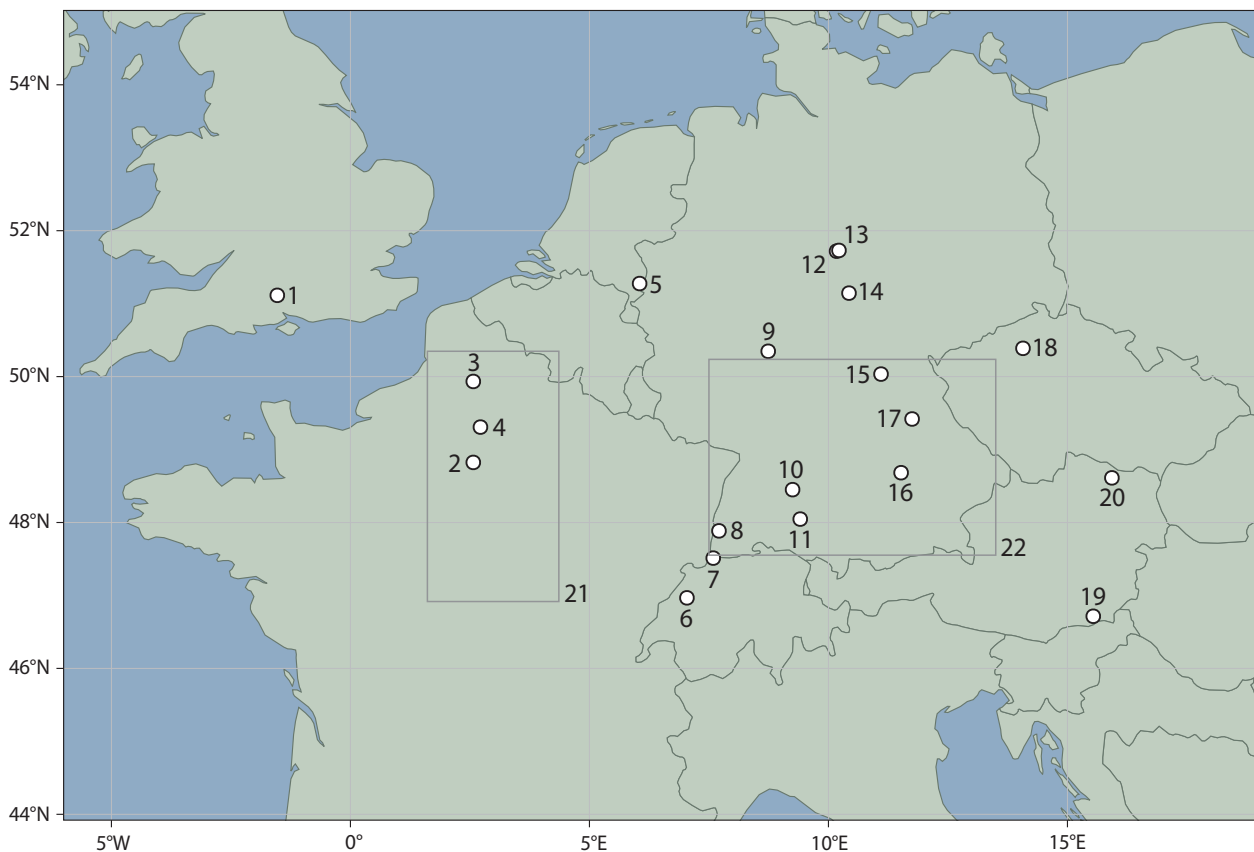


Abb. 2. Eisenzeitliche Fundorte mit größeren Mengen einzelner menschlicher Knochen: 1 Danebury; 2 Gournay-sur-Arond; 3 Ribemont-sur-Ancre; 4 Vallée de l'Oise; 5 Kessel; 6 Cornaux; 7 Basel ,Gasfabrik'; 8 Ehrenkirchen-Offnadingen; 9 Bad Nauheim; 10 Reutlingen 'Achalm'; 11 ,Heuneburg'; 12 ,Pippinsburg'; 13 ,Lichtensteinhöhle'; 14 Oberdorla; 15 ,Hohle Stein'; 16 Manching; 17 Egloffstein 'Dietersberghöhle'; 18 Radovesice; 19 Frauenberg; 20 Roseldorf; 21 Habitats Gaulois; 22 Siedlungsbestattungen Bayern/Baden-Württemberg (Grafik: Karin Winter).

Tabelle 1 (Fortsetzung nächste Seite). Eisenzeitliche Fundorte mit größeren Mengen einzelner menschlicher Knochen.

Fundort	Charakter	n	Datierung	Literatur	Bemerkungen
Haglund 1997	Div. Fälle von Karnivoren-fraß		rezent	Haglund 1997, 376 Tab. 3	N = 47; die jew. Knochenanzahl wurde aus den proz.n Anteilen der Spalten „Stage 1“ bis „4“ sowie „atypical“ errechnet und diese dann zusammengefasst; der Schädel wurde generell mit „1“ gerechnet
Bad Nauheim	Siedlung	142	LtA–D	Lange 1995, 284 Tab. 1; 309–319	Angaben dem recht ausführlichen Fundkatalog entnommen; größere zusammenhängende Schädelstücke wurden nur einfach gezählt; keine Kleinkindknochen
Basel 'Gasfabrik'	Siedlung	250	150–80 v. Chr.	Jud 2008, 53 Tab. 1	Jud gibt für zwei Grabungszeiträume die Knochenerhaltung in Prozent an, dabei keine Trennung nach Alter. Craniale Knochen werden nur insg. angegeben.
Cornaux	Brücke und Heiligtum	68	LtC 2 oder später (Ende 2. Jh. v. Chr.)	Sauter 1990, 138–139; Jud 2007, 394 (zu den Einzelknochen); Müller 2007, 352–353 (Datierung)	Neben 15 mehr oder weniger vollständigen Skeletten (nicht aufgenommen) wurden einzelne Schädel und Teile des postkranialen Skeletts gefunden. Eine Unterteilung nach Alter erfolgte nicht. Genaue Zahl der Rippenfragm. nicht angegeben, unbest. Zahl von Phalangenfragmenten wurde mit „1“ gerechnet.
Danebury	Befestigte Höhensiedlung	1151	6–1. Jh. v. Chr.	Craig <i>et al.</i> 2005, 171 Tab. 1	Aufsatz und Auflistung umfassen die menschl. Knochen aus den Gruben 374, 923, 1078 und P2509, keineswegs den ges. Knochenbestand von Danebury. Diese enthielten vermischte Knochen von Individuen versch. Altersstufen. Trennung nach Alter o. Einzelknochen unmöglich.
Ehrenkirchen-Offnadingen	Siedlungsgrube	401	LtA	Unpubliziert (C. Berszin)	Nur Erwachsene berücksichtigt.
Egloffstein 'Dietersberghöhle'	Höhle	156	HaC–LtB	Baum 1999	Ausführliche Auflistung, ausschließlich erwachsene Individuen aufgenommen. Baum geht von einer starken Selektion bei der Bergung aus.
Frauenberg	Heiligtum	54	LtD	Grill 2009, 293; 344–360	Detaillierter Katalog, nur Erwachsene einbezogen, ohne einzelne Zähne.
Gournay-sur-Aronde	Heiligtum	68	LtC	Brunaux <i>et al.</i> 1985, 148 Tab. 1	Detaillierte Auflistung, die allerdings nur die Minimalzahl der Fragmente enthält, da als zusammengehörig angesehene Fragmente offenbar nur einmal gezählt wurden. Der Bestand enthält keine nicht-erwachsenen Individuen.
Habitats Gau-lois	8 Siedlungen in Nordfrankreich	74	LtD	Méniel 1989	Detaillierte Auflistung, keine Trennung nach Alter.
„Heuneburg“	Befestigte Höhensiedlung	49	HaD	Wahl 1995, 365–369	Nur Knochen von erwachsenen Individuen einbezogen.
„Hohle Stein“	Naturheiligtum	331	HaC–D	Hendel und Noack 2013; pers. Mitt. E. Noack	Nur Knochen von erwachsenen Individuen einbezogen. Die 79 nicht nach Hand oder Fuß differenzierten Phalangen wurden hälftig auf beide Gruppen aufteilt.
Kessel	Baggerfund	588 (nur Erw.)	C ¹⁴ -Daten größtenteils vorrömische Eisen- u. röm. Kaiserzeit, aber auch einige hochmittelalterliche Daten	ter Schegget 1999, 212 Tab. 3	Die Knochen sind genau aufgeschlüsselt und nach Alter getrennt, Nichterwachsene sind hier nicht mitgezählt. Bei den Schädelknochen geht Autor:in von einer zusätzlichen Zerscherbung durch die Aufbaggerung aus.

Fundort	Charakter	n	Datierung	Literatur	Bemerkungen
Lichtensteinhöhle	Höhle	5475	HaB	Flindt <i>et al.</i> 2013, 354 Tab. 1	Keine Trennung nach Alter. Es fehlen Angaben zu den Schädelknochen außer der Mandibula.
Manching	Oppidum	5335	LtC–D	Lange 1983, 4 Tab. 1; 31 Tab. 13 (Unterkiefer); 93 (Wirbel); Hahn 1992, 215 Tab. 9; 224 Tab. 10 (Unterkiefer); Hahn 2013, 671 Tab. 1; 690 (Unterkiefer)	Keine Trennung nach Alter in den Tabellen. Diese führen auch nur Werte für Schädelknochen insgesamt auf, Unterkiefer aber an anderer Stelle separat aufgelistet. Die Werte für Rippen, Hand- u. Fußknochen sind weder bei Lange noch bei Hahn angegeben, sie verbergen sich unter „Sonstiges“, machen aber insg. nur 92 Fundstücke aus.
Oberdorla	Heiligtum	19	HaC–Lt	Ullrich 2003	Der Katalog erlaubt ein Herausfiltern der hallstatt- und latènezeitlichen menschl. Knochen, der Hauptteil ist kaiserzeitlich. Eindeutig nicht-erwachsene Individuen sind nicht belegt.
'Pippinsburg'	Befestigte Höhensiedlung	76	LtB2–C	Caselitz und Schlüter 2013, 100–109 Anhang 1	Ausführliche Auflistung, ausschließlich erwachsene Individuen aufgenommen.
Radovesice	Siedlung	13	HaD–LtD	Hanáková 1993	Nur Erwachsene, keine vollständigen Skelette
Reutlingen 'Achalm'	Befestigte Höhensiedlung	159	HaD–LtB1	Fiedler <i>et al.</i> 2009, 108 Tab. 1	Eine Trennung nach Alter erfolgt in der Tabelle nicht. Ohne einzelne Zähne.
Ribemont-sur-Ancre „Charnier“	Heiligtum	ca. 10.000	LtC	Duday 1998, 117 Abb. 111	Werte für die Knochen sind der Abbildung entnommen. Diese gibt Überlieferung der Knochen in 10%-Schritten an, wobei der Bezugspunkt der linke Talus (n = 75) ist. Für die Rückrechnung wurde der jew. Mittelwert angesetzt. Phalangen der Hand u. des Fußes sind nicht erfasst und auf Grundlage der übrigen Hand- u. Fußknochen interpoliert. Im Text wird ferner je ein Schädel- und ein Mandibulafragment erwähnt.
Roseldorf	Heiligtum	392	4–1. Jhr. v. Chr.	Teschler-Nicola <i>et al.</i> 2009, 261 Tab. F-1	Eine Trennung nach Alter erfolgt in der Tabelle nicht.
Siedlungsbestattungen	Siedlungen	70	HaC–LtA	Unpubliziert	Siedlungen in Baden-Württemberg ohne Ehrenkirchen-Offnadingen, 'Heuneburg' und Reutlingen 'Achalm', nur Erwachsene berücksichtigt
Vallée de l'Oise	4 offene Flachlandsiedl.	44	LtC	Malrain und Pinard 2006, 235–236	Detaillierte Auflistung, nur Erwachsene aufgenommen.

Erfasst wurden nur Einzelknochen, d. h. keine mehr oder weniger vollständigen Individuen. Sofern möglich, beschränkt sich die Betrachtung auf erwachsene Individuen, da insbesondere Kleinkinder während der Eisenzeit eine Sonderbehandlung erfahren haben (Beilke-Voigt 2010).

Bisher hat sich noch keine einheitliche Aufzählung der Körperregionen durchsetzen können. Eine separate Erfassung der Langknochen geschieht meist und ist sicherlich auch sinnvoll. Wenn erfasst, werden Fuß- und Beinknochen meist jeweils aufsummiert, Ähnliches

gilt für Rippen und Wirbel. Problematisch ist insbesondere die Zählweise des Schädels, der streng genommen aus 23 einzelnen Knochen besteht. Hinzu kommen 28 bzw. 32 Zähne. Soweit dies die publizierten Daten erlauben, wurde jedes Schädelfragment mit zusammenhängenden Knochen nur einmal gezählt (ohne einzelne Zähne). Damit würden selbstverständlich stark zerscherbte Schädel mit einem stärkeren Gewicht in die Berechnung eingehen als gut erhaltene, aber Gleiches gilt auch für die Langknochen.

Leider stellt sich weiterhin das Problem, dass die einschlägige Literatur nicht immer alle menschlichen Körperregionen aufführt. Insbesondere Hand- und Fußknochen sowie die Elemente der Wirbelsäule und der Brustregion werden häufig nicht gesondert aufgeführt. Will man diese unvollständigen Daten nicht unberücksichtigt lassen, müssen die Fehlstellen durch Imputation ergänzt werden. Dafür wird hier auf bayesche Modellierung zurückgegriffen, deren Methodik unten näher erläutert wird.

Ein weiterer Faktor, der allerdings kaum kalkulierbar ist, stellen die Grabungsbedingungen dar. Insbesondere für viele ältere Grabungen ist damit zu rechnen, dass kleinere Knochen unentdeckt blieben, was zu ihrer Unterrepräsentanz führen muss; davon wären wohl insbesondere Hand- und Fußknochen betroffen.

In Tabelle 1 sind die Kerndaten aufgeführt und die oben angesprochenen Punkte (Zählweise, Alter, erfasste Knochen) erörtert.¹ Um die von der Korrespondenzanalyse herausgearbeiteten Dimensionen angemessen interpretieren zu können, ist eine Kategorisierung der

Fundplätze nützlich. Neben der räumlichen oder chronologischen Unterteilung bietet sich hier in erster Linie eine der Funktion an. In der tabellarischen Übersicht wurde folgende Differenzierung getroffen:

- Höhensiedlung (z. B. „Heuneburg“)
- Flachlandsiedlung (z. B. Bad Nauheim)
- Oppidum (z. B. Manching)
- Höhle (z. B. „Dietersberghöhle“)
- Heiligtum (z. B. Gournay)

Chronologisch wurde lediglich zwischen Fundplätzen der Älteren und solchen der Jüngeren Eisenzeit differenziert. Zu ersterer wurde die Urnenfelder-, die Hallstatt- sowie die Frühlatènezeit gezählt, die Jüngere Eisenzeit umfasst demzufolge Mittel- und Spätlatènezeit. Ausschlaggebend für diese phaseologische Trennung war das Ende „regulärer“ Bestattungsplätze mit dem Ende der Frühlatènezeit einerseits und das Aufkommen von Heiligtümern wie Gournay und der Oppida in der Mittellatènezeit andererseits.

METHODIK

Die Korrespondenzanalyse hat seit den 1980er Jahren in der deutschsprachigen Archäologie einen festen Platz (grundlegend: Ihm 1983). Sie eignet sich vor allem für die explorative Analyse kategorialer Daten, die in Form einer Kontingenztafel vorliegen (Greenacre 1993; Müller *et al.* 1997). Insofern ist sie ein geeignetes Werkzeug, um gemeinsame Strukturen bei der Kombination von Knochenelementen herauszuarbeiten. Ein solches Vorgehen hat beispielsweise auch Sara Schiesberg (2013) für neolithische Kollektivgräber erfolgreich angewandt.

Die Logik der Auffüllung lückenhafter Daten und anschließender Verarbeitung mittels Korrespondenzanalyse folgt weitgehend Jules de Tibeiro und Duncan Murdoch (2010). Die Zellen der Kontingenztafel werden durch ein loglineares Modell modelliert, das mit leichten Modifikationen von John Kruschke (2015, 708–711) übernommen wurde. Leere Zellen werden dabei automatisch mit Werten gefüllt, die sich aus der Likelihood-Funktion sowie Werten anderer Zellen ergeben (Plummer 2017, 15). Die MCMC-Simulationen umfassen insgesamt 10.000.000 Schritte, von denen jeder fünfhundertste behalten wird (*thinning* = 500). Für die Beurteilung, ob die Simulationen ausreichend viele Schritte beinhalten, werden gemeinhin die „effektive Stichprobengröße“ (*effective sample size*, ESS) sowie der

„potentielle Skalenreduktionsfaktor“ (*potential scale reduction factor*, PSRF) herangezogen (Kruschke 2015, 181–184). Die ESS sollte 10.000 oder höher sein, der PSRF 1.1 oder kleiner.

Für die Auffüllung der Lücken wird Jules de Tibeiro und Duncan Murdoch (2010, 525) gefolgt und der Medianwert der posterioren Verteilung der Parameter gewählt. Für die Darstellung der Unsicherheiten wird, ebenfalls Jules de Tibeiro und Duncan Murdoch (*ibid.*, 526) folgend, $\log(\lambda)$ gewählt. Von den insgesamt 20.000 gespeicherten Schritten werden 1.000 zufällig ausgewählt und mit jedem dieser Datensätze eine Korrespondenzanalyse durchgeführt. Deren Ergebnisse lassen sich dann auf dieselbe Ebene projizieren, wobei zusammengehörige Datenwolken aus Gründen der Übersichtlichkeit als Ellipsen dargestellt werden. Diese sind so gewählt, dass sie jeweils 95% der Punkte jedes Parameters beinhalten. Sie stecken einen „glaubhaften“ (*credible*) Rahmen der „wahren“ Verteilung ab und können demzufolge auch als „Kreditabilitätsellipsen“ bezeichnet werden.

Trevor Ringrose (2012, 1401) wies im Zusammenhang mit dem analogen frequentistischen Vorgehen mit Bootstrapping auf zwei mögliche Probleme bei der Erzeugung von Unsicherheitsellipsen in den Ordinationsdiagrammen von Korrespondenzanalysen hin: Erstens

1 Die vollständigen Daten sind abrufbar unter:
<https://doi.org/10.57892/100-312>

ist nicht gesichert, dass alle Achsen der vielfach wiederholten Korrespondenzanalyse dasselbe Vorzeichen besitzen werden, und zweitens kann sich auch die Reihenfolge der Achsen zwischen den Wiederholungen ändern.

Zwar ist die Problematik nicht von der Hand zu weisen, im vorliegenden Fall scheint sie aber keine praktischen Auswirkungen zu haben. Sie könnte höchstens dazu führen, dass die Ellipsen unsicherer erscheinen, als sie sein müssten. Außerdem lässt sich m. E. durchaus argumentieren, dass auch die Beibehaltung bzw. Nicht-Beibehaltung derselben Achsenfolge oder desselben Vorzeichens ein Qualitätskriterium sein kann. Würde

sich die Reihenfolge häufig ändern und damit die Ellipsen einen großen Unsicherheitsbereich eingrenzen, so spräche das zurecht für eine geringe Zuverlässigkeit der Ergebnisse der Korrespondenzanalyse.

Alle Analysen wurden mit der Script-Sprache R (Vers. 4.3.1) durchgeführt. Die bayessche Modellierung erfolgte mit JAGS 4.3.1 (Plummer 2003), auf das mit dem R-Paket „runjags“ (Vers. 2.2.2; Denwood 2016) zugegriffen wird. Die Korrespondenzanalysen wurden mittels des R-Pakets „FactoMineR“ (Vers. 2.8; Lê *et al.* 2008) durchgeführt. Der zugrunde liegende Code ist unter derselben Adresse wie die Daten online zugänglich.

ERGEBNISSE

Sowohl die Bedingung für die „effektive Stichprobengröße“ wie auch die für den „potentiellen Skalenreduktionsfaktor“ sind mit der angegebenen Schrittzahl erreicht, insofern können die Ergebnisse des JAGS-Modells als stabil angesehen werden. Auch ein „posteriorer Vorhersagetest“ (*posterior predictive check*; nicht abgebildet) zeigt, dass die tatsächlichen Daten gut durch das Modell beschrieben werden. Die imputierten Werte lassen sich leider nur stichprobenartig auf ihre Plausibilität überprüfen. Für Basel-Gasfabrik liegen nur summarische Zahlen für alle cranialen Knochen vor, also ohne Trennung nach Schädelkalotte und Unterkiefer. Demnach wurden bei den verschiedenen Grabungszeiträumen bis zum Jahr 1990 104 Schädelknochen geborgen (Jud 2008, 53 Tabelle 1). Das bayessche Modell hat allerdings für Basel-Gasfabrik im Median nur insgesamt 48 Schädelknochen (41 Schädel plus sieben Unterkiefer) angesetzt, unterschätzt also die tatsächliche Anzahl. Umgekehrt ist für die ‚Lichtensteinhöhle‘ zu konstatieren, dass die geschätzte Menge von 486 Schädelknochen (ohne Unterkiefer) angesichts der Mindestindividuenzahl von lediglich 65 (Flindt *et al.* 2013, 354 Tabelle 1) zu hoch erscheint, zumindest sofern zusammenhängende Schädelknochen nur einmal gezählt werden.

Bei der einfachen Korrespondenzanalyse mit Originalwerten und den auf der Basis des bayesschen Modell aufgefüllten Lücken decken die ersten drei Dimensionen bereits 91,1 % der Varianz ab. Der Löwenanteil entfällt mit 60,0 % auf die erste Dimension, die zweite Dimension folgt mit 23,2 % weit dahinter, und die dritte trägt nur noch 8,0 % bei.

Die erste Dimension folgt erkennbar demselben Muster, wie es oben für das Beispiel aus der Sierra Madre festgestellt wurde (Abb. 3): In der linken Diagrammhälfte finden sich in erster Linie die kleineren Knochen von Hand und Fuß sowie Wirbel und Rippen, dann folgen etwas größere und massivere Knochen wie

Schulterblatt, Schlüsselbein und Kniescheibe. Exakt in der Mitte steht das Becken. In der rechten Diagrammhälfte stellen die kleineren Langknochen Speiche, Elle und Wadenbein eine erste Gruppe dar, während ganz rechts die massivsten Langknochen Ober- und Unterschenkelknochen sowie Oberarmknochen zu finden sind. Unterkiefer und Schädel ergänzen diese Gruppe.

Die zweite Dimension differenziert offensichtlich in erster Linie zwischen Hand- und Fußknochen sowie Kniescheibe einerseits und Brustkorb (Rippen, Sternum, Wirbel, Sakrum) andererseits. Entlang der dritten Dimension stehen vor allem Unterkiefer und Schädel den massiven Langknochen Ober- und Unterschenkelknochen sowie Oberarmknochen gegenüber.

Bei den Fundorten ist die linke Diagrammhälfte in Hinsicht auf die erste Dimension etwas dünner als die rechte besetzt. Die Erwartungswerte und der Datensatz von William Haglund (1997) finden sich hier, zudem die ‚Lichtensteinhöhle‘, Danebury, Ehrenkirchen-Offnadingen, der ‚Hohle Stein‘ und schließlich der *Charnier* von Ribemont. Alle anderen Fundorte liegen im positiven Bereich der ersten Dimension.

Die zweite Dimension spaltet auch bei den Fundorten in erster Linie diejenigen des negativen Bereichs der ersten Dimension auf. Im positiven Spektrum liegen Danebury, Ehrenkirchen-Offnadingen und der Datensatz von William Haglund, außerdem Gournay und Cornaux, während im negativen Bereich vor allem Ribemont zu finden sind. Die Erwartungswerte, der ‚Hohle Stein‘ und die ‚Lichtensteinhöhle‘ verhalten sich eher indifferent. Ähnliches gilt für die meisten Fundorte in der rechten Diagrammhälfte der ersten Dimension.

Umgekehrt wirkt sich die dritte Dimension in erster Linie genau auf die Fundorte aus, die in den positiven Bereich der ersten Dimension fallen. Im negativen Wertebereich liegen vor allem die Fundorte Radovesice, Reutlingen ‚Achalm‘, die ‚Heuneburg‘,

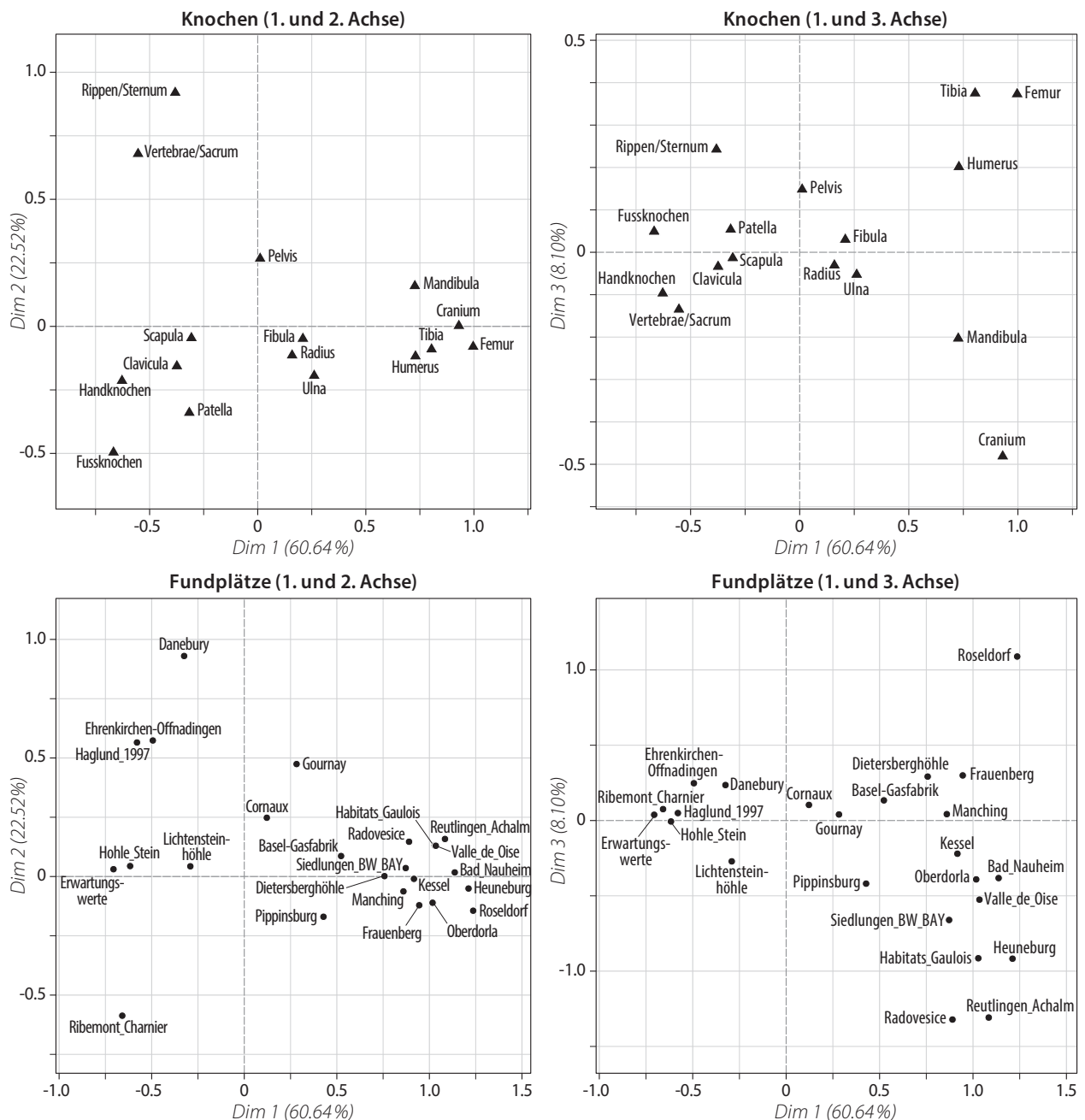


Abb. 3. Ordinationsdiagramme einer Korrespondenzanalyse mit den Knochen der Fundplätze von Tabelle 1; **oben**: Spaltenprofile (= Knochen); **unten**: Zeilenprofile (= Fundplätze); **links**: 1. und 2. Dimension; **rechts**: 1. und 3. Dimension.

die verschiedenen zusammengefassten Siedlungen in Frankreich und Süddeutschland, Bad Nauheim, Oberdorla, die Pippinsburg und Kessel. Dem stehen in der oberen Diagrammhälfte die Fundorte Roseldorf, Frauenberg, die ‚Dietersberghöhle‘ und Basel-Gasfabrik gegenüber. Manching liegt nahe der 0-Linie.

Nimmt man nun die Ellipsen hinzu, so erhält man eine bessere Übersicht über die Unsicherheiten bei der Positionierung sowohl der Knochen (Abb. 4) wie auch der Fundorte (Abb. 5). Bei erster und zweiter Dimension

sind die eine große Fläche abdeckenden Ellipsen von Rippen/Sternum und Wirbel/Sacrum auffällig, auch Kniescheibe und Handknochen umfassen einen großen Unsicherheitsbereich. Demgegenüber weisen die Fußknochen eine deutlich kleinere Größe auf. Die übrigen Langknochen folgen der Ordnung, wie sie bereits für die einfache Korrespondenzanalyse festgestellt wurde, wobei sich die Ellipsen der Knochen zusammengehöriger Gruppen weitflächig überlappen, ansonsten aber kaum Berührungspunkte bestehen. Die Hinzunahme

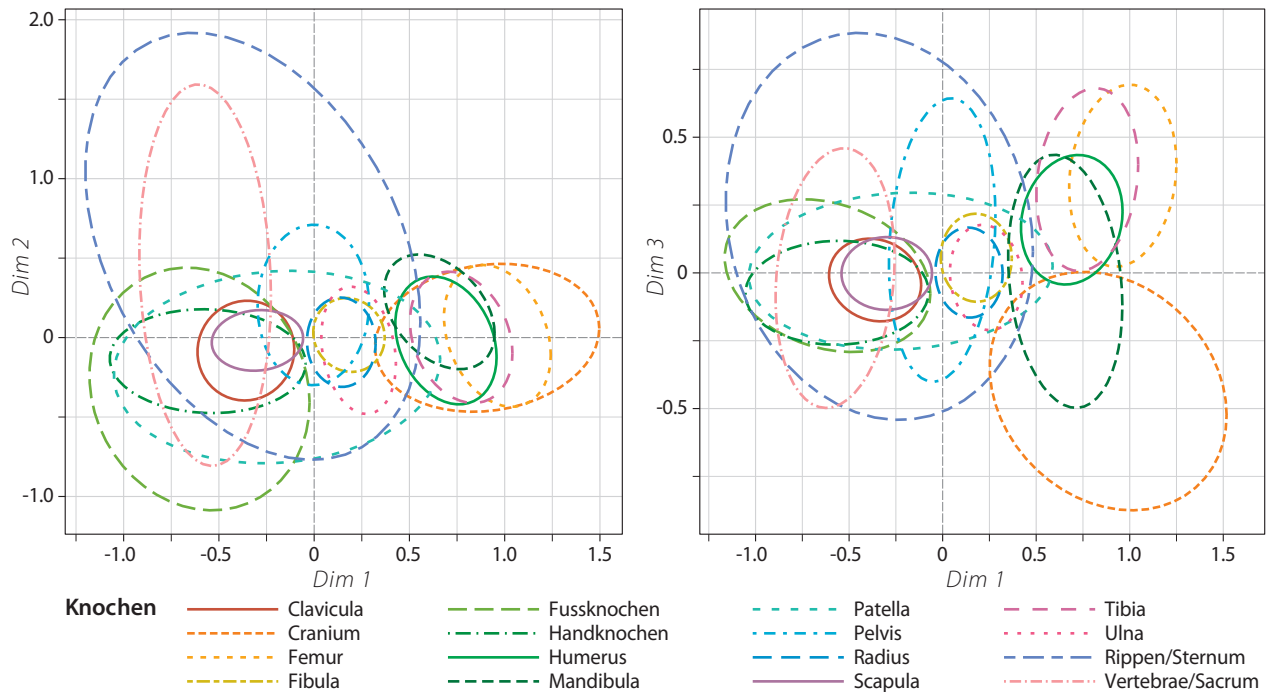


Abb. 4. Kredibilitätsellipsen von 1.000 Korrespondenzanalysen mit simulierten Werten der Fundplätze von Tabelle 1; links: 1. und 2. Dimension; rechts: 1. und 3. Dimension der Spaltenprofile (= Knochen).

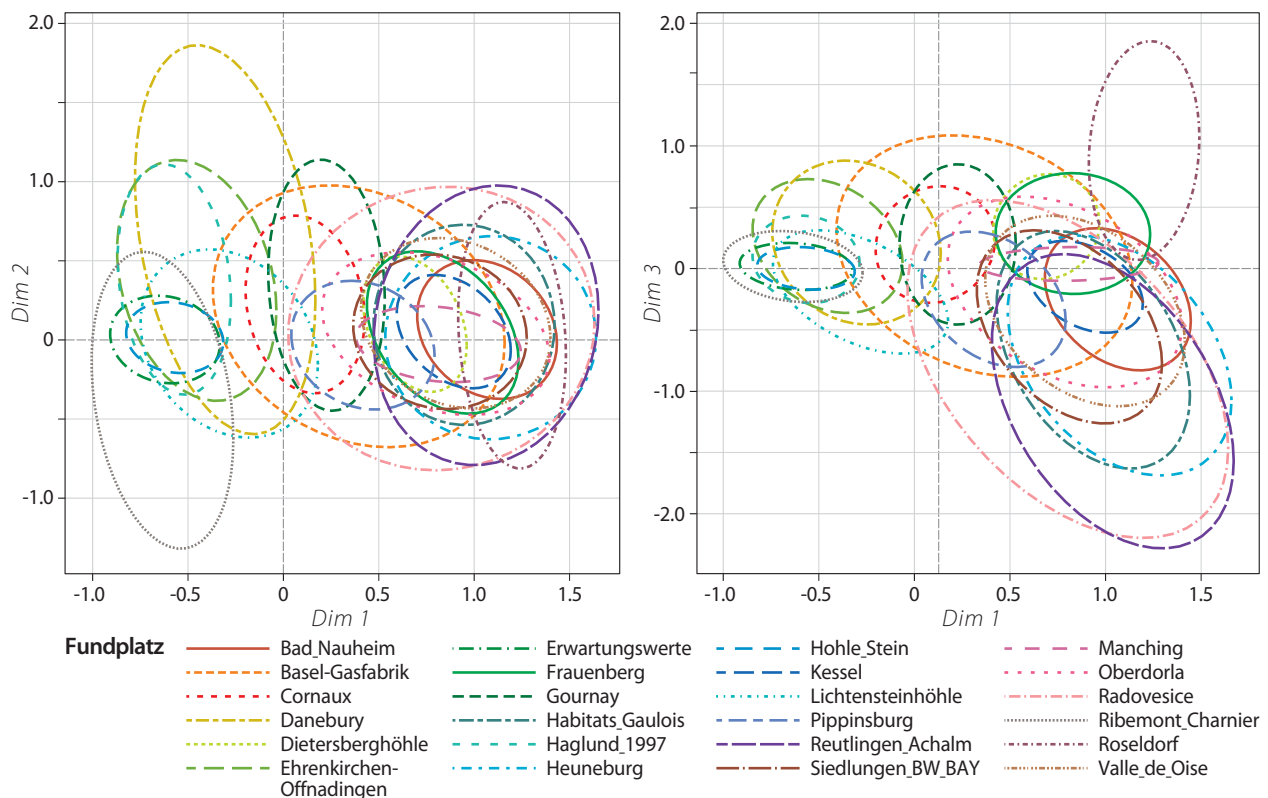


Abb. 5. Kredibilitätsellipsen von 1.000 Korrespondenzanalysen mit simulierten Werten der Fundplätze von Tabelle 1; links: 1. und 2. Dimension; rechts: 1. und 3. Dimension der Zeilenprofile (= Fundplätze).

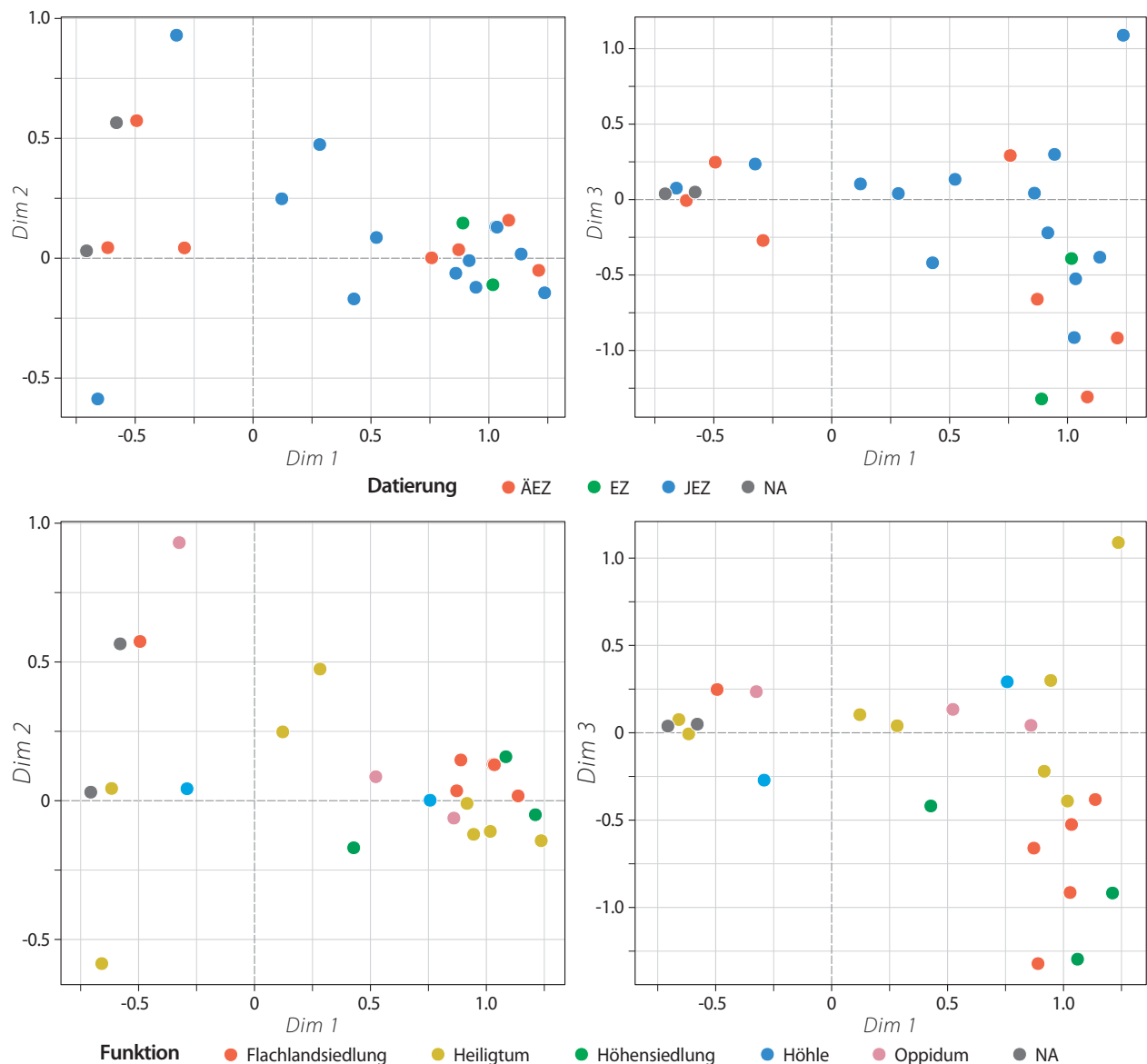


Abb. 6. Ordinationsdiagramme einer Korrespondenzanalyse mit den Knochen der Fundplätze von Tabelle 1 mit thematischer Kategorisierung; **oben:** Datierung; **unten:** Funktion; **links:** 1. und 2. Dimension; **rechts:** 1. und 3. Dimension.

der dritten Dimension führt vor allem bei den größten Langknochen und dem Schädel zu einer Ausdifferenzierung. Die Ellipsen von Schädel einerseits und Ober- und Unterschenkelknochen andererseits überlappen sich dabei nicht, während die Ellipse des Unterkiefers zwischen beiden vermittelt.

Bei den Fundorten (Abb. 5) springen die großflächigen Ellipsen von Radovesice oder auch Basel-Gasfabrik ins Auge. Im Vergleich der Diagramme für erste und zweite sowie erste und dritte Achse fällt weiter auf, dass bei ersterem Diagramm Ribemont und Danebury relativ großflächige Ellipsen besitzen. Beim Diagramm von erster und dritter Dimension sticht die Roseldorf

zugehörige Ellipse heraus, die sich mit etlichen der Ellipsen der Fundorte des negativen Bereichs der dritten Dimension nicht überlappt.

Eine Differenzierung der Fundorte nach Datierung oder Funktion (Abb. 6) ergibt kein klares Bild. Fundorte der Älteren und Jüngeren Eisenzeit finden sich in allen Bereichen aller drei Dimensionen. Allerdings lässt sich konstatieren, dass im rechten oberen Diagrammviertel der Dimensionen eins und drei lediglich ein Fundort der Älteren Eisenzeit (Dietersberghöhle) liegt. Ähnliches trifft auf Flachland- und Höhensiedlungen zu, die dort ebenfalls fehlen.

DISKUSSION

Das bayessche Modell hat sich als robust erwiesen in Hinsicht auf die Vorhersage der bekannten Werte. Andererseits sollten von einem solchen Modell auch keine Wunderdinge erwartet werden. Dies ließ sich stichprobenartig an den Datensätzen von Basel-Gasfabrik oder der ‚Lichtensteinhöhle‘ zeigen. Immerhin wurde die tatsächliche Zahl der Schädelknochen von Basel-Gasfabrik um „nur“ knapp 50 % unterschätzt, was angesichts der Log-Skalierung der Knochenzahl wenig ins Gewicht fällt. Bei der starken Überschätzung der Schädelknochenzahl im Falle der ‚Lichtensteinhöhle‘ um den Faktor 7–8 offenbart sich das Dilemma des unterschiedlichen Fragmentierungsgrads, der für Schädel offensichtlich deutlich stärker ins Gewicht fällt als für andere menschliche Knochen.

Angesichts der Schwankungsbreiten sollte eine um simulierte Daten ergänzte Korrespondenzanalyse auch zwingend eine Analyse dieser Unsicherheiten beinhalten. Dafür zeigt sich die Darstellung mittels Ellipsen als wertvoll, da hierbei imputierte Werte (z.B. Basel ‚Gasfabrik‘) und kleine Stichprobengrößen (z.B. Radovesice) durch großflächigere Ellipsen „bestraft“ werden. In Hinsicht auf die Darstellung der Knochen ist v.a. auf diejenigen hinzuweisen, die die zweite Dimension besonders beeinflussen (Hand- und Fußknochen, Brustkorb). Die Ellipsen dieser Knochen überlappen sich großflächig, was als Indiz genommen werden darf, dass dieser Dimension keine allzu große Bedeutung zugemessen werden sollte. Unter den wenigen Fundorten, die diese Dimension aufspannen, befindet sich zudem der *Charnier* von Ribemont, bei dem die Zahlen für die Knochen des Brustkorbs durch Simulationen ergänzt werden mussten. Trotz dieser Einschränkung ist dennoch möglich, dass die Dimension einen grundsätzlich interessanten Sachverhalt widerspiegelt. Zu verweisen ist hier auf die Assoziation der Fundorte Danebury und Ehrenkirchen-Offnadingen mit dem Datensatz von William Haglund (1997). Letzterer dokumentiert ausdrücklich die Auswirkungen von größeren Raubtieren (Hunden) auf offen ausgelegte Leichname. Diese sind in der Lage, auch bei noch nicht vollständig zersetzten Körpern größere Partien zu entfernen, wofür als erstes Hände und Füße infrage kommen. Ein solches Szenario ist auch für Danebury und Ehrenkirchen-Offnadingen gut vorstellbar. Um diese Schlussfolgerung zu erhärten, sind aber noch weitere einschlägige Datensätze notwendig. Die weitflächige Überlappung der Kreditabilitätsellipsen zeigt an, dass die derzeitige Anzahl noch unzureichend ist.

Im Gegensatz dazu demonstriert die Aufspaltung der Knochen und Fundorte entlang der ersten und dritten Achse mit sich teilweise nicht überlappenden Ellipsen, dass diese beiden Dimensionen „signifikante“

Unterschiede widerspiegeln. Es ist offensichtlich, dass die erste Dimension zwischen relativ vollständig überlieferten Skeletten (negativer Bereich) und unvollständigen Skeletten (positiver Bereich) differenziert. Im Extremfall umfassen letztere lediglich die größten Langknochen sowie den Schädel, die wiederum von der dritten Dimension aufgeteilt werden. In den Siedlungen Frankreichs und Süddeutschlands, auf der ‚Heuneburg‘, auf der ‚Achalm‘ bei Reutlingen genauso wie in Radovesice sind vor allem Knochen des Craniums (ohne Unterkiefer) gefunden worden, während vor allem in Roseldorf, aber auch dem ‚Frauenberg‘, Basel-Gasfabrik und Manching große Langknochen geborgen wurden.

Es dürfte auf der Hand liegen, dass für diese differenzierte Auswahl entlang der dritten Dimension in erster Linie menschliche Intervention verantwortlich ist. Dies lässt sich sehr gut anhand der ‚Dietersberghöhle‘ zeigen. Hier ist das Handeln allerdings nicht in prähistorischer Zeit zu verorten, sondern

„der bedeutendste Auslesefaktor für das Knochenmaterial aus der Dietersberghöhle [war] der Ausgräber selbst.“
(Baum 1999, 91)

Vom umfangreichen Skelettmaterial sind der Nachwelt nur Schädel und Extremitätenknochen erhalten (*ibid.*). Die Position der ‚Dietersberghöhle‘ im Ordinationsdiagramm spiegelt also keineswegs prähistorische Deponierungssitten wider, sondern die Grabungspraxis der 1930er Jahre. Für die anderen Fundorte in diesem Bereich des Ordinationsdiagramms gilt dies aber nicht, so dass in prähistorischer Zeit offenbar ähnlich selektiv mit den menschlichen Knochen umgegangen wurde. Kritisch muss man allerdings vermutlich gegenüber dem Fundort Kessel sein, da hier durch die Aufbaggerung der Knochen eine Knochenselektion stattgefunden hat.

Ein klares Schema der Behandlung der Knochen nach Zeit oder Funktion hat sich bei den Resultaten nicht ergeben. Hier ist allerdings zu berücksichtigen, dass die aufgenommenen Knochen teilweise über mehrere Hundert Jahre hinweg deponiert wurden. Neben dieser zeitlichen Komponente ist ferner davon auszugehen, dass an demselben Fundplatz durchaus auch gleichzeitig unterschiedliche Deponierungs- und Selektionspraktiken ausgeübt wurden. Dies dürfte insbesondere für die Siedlungsplätze gelten. Ein Beispiel dafür ist Danebury. Hier suggeriert die Korrespondenzanalyse die Niederlegung vollständiger Körper, was für das Gros der Knochen sicherlich richtig ist. Dennoch gibt es für die einbezogenen Gruben auch eindeutige Hinweise für Enthauptungen (Craig *et al.* 2005, 170–171). Ein

anderes Beispiel stellt Manching dar, bei dem geradezu von einer „sakralen Stadtlandschaft“ (Wendling 2021) gesprochen werden kann. Sofern im Siedlungszentrum andere Deponierungspraktiken als im Rest der Siedlung geherrscht haben sollten, so würden diese bei der Masse an geborgenen menschlichen Knochen kaum erkennbar sein.

Betrachtet man unter diesem Aspekt die Abbildung zur Differenzierung nach Funktion, so ergeben sich möglicherweise doch noch einige Interpretationsansätze. Bei den Fundplätzen im stärker negativen Bereich der dritten Dimension — also solchen, bei denen bevorzugt Schädelteile deponiert wurden — handelt es sich ausschließlich um Flachland- oder Höhensiedlungen. Im rechten oberen Quadranten der ersten und dritten Dimension finden sich dagegen ausschließlich Oppida und Heiligtümer, sofern die ‚Dietersberghöhle‘ aus den oben genannten Gründen vernachlässigt wird. Wenn auch Kessel beiseite gelassen wird, bleibt einzig Oberdorla, das die Trennung zwischen Siedlungen und Oppida/Heiligtümern durchbricht.

Wie bereits mehrfach beschrieben, sind letztere vor allem durch die Präsenz der großen Langknochen definiert, während bei ersteren Schädelknochen dominieren. Es ist verlockend, hier eine komplementäre Deponierungspraxis zu vermuten: In den Siedlungen würden dann in erster Linie Schädel kuratiert, in den Heiligtümern und Oppida wären dagegen die zugehörigen Langknochen deponiert. Hier ist allerdings auch die zeitliche Komponente nicht zu vernachlässigen: *Qua definitionem* gehören die Oppida der jüngeren Eisenzeit an, während die Siedlungen sowohl die Ältere wie die Jüngere Eisenzeit abdecken. Auch die Heiligtümer dieses Bereichs sind allesamt jünger. Sofern also tatsächlich eine Trennung zwischen kranialen und postkranialen Knochen stattgefunden hat, würde die gesonderte Behandlung des postkranialen Teils des Körpers ausschließlich eine jüngereisenzeitliche Praxis darstellen. Bemerkenswert ist dabei die enge Bindung zwischen Heiligtum und Oppidum.

Zum Schluss ist allerdings nochmals auf die breite Streuung gerade der Heiligtümer entlang der ersten Dimension hinzuweisen. Ribemont stellt hier das eine Extrem dar, da alle Teile des menschlichen Körpers in annähernd zu erwartenden Relationen vertreten sind — mit Ausnahme des Schädels. Das Zutreffen der schaurigen Rekonstruktion von kompletten ausgestellten Torsi (Brunaux 1995, 70 Abb. 64) ist schwer von der Hand zu weisen. Für andere Fundplätze wie Gournay oder Cornaux wird eine ähnliche Interpretation in Anspruch genommen, aber hier zeigt die Positionierung im Ordinationsdiagramm an, dass die Zusammensetzung der Knochen doch bereits einer starken Selektion unterlag. Gleichzeitig sind sowohl aus Gournay wie aus Cornaux wesentlich mehr Schädelknochen

belegt als von dem *Charnier* von Ribemont bei gleichzeitig wesentlich weniger Knochen insgesamt. Dies zeigt an, dass in der Jüngeren Eisenzeit der Umgang mit dem menschlichen Körper sehr vielfältig ausgesehen hat und sich allzu einfachen Erklärungsmustern möglicherweise entzieht.

Die hier vorgebrachten Überlegungen sind keineswegs komplett neu. Es stellt sich allerdings die Frage, ob das Postulat einer typologischen Entwicklung in Bezug auf den Schädel von einem „Amulettcharakter in der Frühzeit über einen ausgeprägten Ahnen- bzw. Reliquienkult bis hin zu einem Trophäenkult in der Spätzeit“ (von Berg 2011, 79) der Komplexität der Befunde wirklich gerecht wird. Eine differenziertere Sichtweise liefert Ian Armit (2012). Er geht für Südfrankreich davon aus, dass die dortigen Schädelfragmente von Kopfgagd stammen (*ibid.*, 170). Dabei sollen die Zurschaustellung der erbeuteten Schädel Schwankungen unterworfen und die Bedeutung der Kopfgagd im 3. und 1. Jahrhundert v. Chr. besonders groß gewesen sein (*ibid.*, 172).

Zieht man die Gräber noch hinzu, wird das Bild noch vielfältiger. Aus der Älteren Eisenzeit, also der Hallstatt- und Frühlatènezeit, sind zahlreiche Gräber bekannt (für die Hallstattzeit: Müller-Scheeßel 2013a; für die Frühlatènezeit: Lorenz 1978). Während bei den hallstattzeitlichen Individuen nur selten Schädel fehlen (z. B. Dietfurt a. d. Altmühl: Röhrig 1994, 220–221 mit Abb. 117), ist die Entnahme von Schädeln in der Frühlatènezeit durchaus häufiger belegt (Gräberfelder von Werneck: Lettmann 2019; im Druck; Dürrnberg: Wendling 2020, 163 Abb. 8.5; Mont Troté: Rozoy 1965). Zumindest die Schädelteile in frühlatènezeitlichen Siedlungen könnten also aus ‚regulären‘ Gräbern stammen. Die Herkunft der kranialen Fragmente in hallstattzeitlichen Siedlungen bleibt jedoch fraglich, die zugehörigen postkranialen Skeletteile fehlen jedenfalls im archäologischen Befund. Im Gegensatz dazu verschwinden ‚reguläre‘ Gräber in der Jüngeren Eisenzeit weitgehend. Mit den immer noch in Siedlungen belegten Schädeln könnten dafür die zahlreich in Oppida und Heiligtümern vertretenen postkranialen Skelettelemente in Verbindung gebracht werden.

Für die in Siedlungen vertretenen menschlichen Knochen wird für England schon seit langer Zeit eine Aussetzung oder Entfleischung („*excarnation*“) menschlicher Leichname vermutet (Carr und Knüsel 1997; Harding 2016). Eine analoge Deutung wurde von Günter Lange (1983; 1995) für die Skelettreste von Manching und Bad Nauheim vorgebracht, was weitgehend unwidersprochen blieb.

Damit ergibt sich für die eisenzeitliche Behandlung menschlicher Überreste im Zusammenspiel von archäologischen Daten und Interpretationen diachron ein widersprüchliches Bild von gleichzeitiger

Unter- und Überdeterminierung. Für die Hallstattzeit wissen wir nicht, woher die Schädel in den Siedlungen stammen, für die Frühlatènezeit könnten sie den Gräbern entnommen sein. Als Motivation liegt dabei eine Form der Ahnenverehrung nahe, aber genauso könnte es sich um einen Akt der Schändung handeln, insbesondere dann, wenn wie im Fall von Werneck die Gräber mehr oder weniger flächendeckend betroffen sind.

In der Jüngeren Eisenzeit stammen die postkranialen Knochen teilweise aus Heiligtümern, für die im Fall von Ribemont ein Tropäum angenommen wird, also ein Ehrenmal für eine erfolgreiche Schlacht, bei der die Körper der Besiegten und Getöteten massenhaft zur Schau gestellt wurden. Die fehlenden Schädel wären dann Trophäen einer Kopffjagd, wie sie ja für die historischen Kelten durchaus belegt ist (Armit 2012, 18–29), und könnten nach einer Einbalsamierung (Ghezel *et al.* 2019) in den Siedlungen ausgestellt oder verwahrt worden sein. Gleichzeitig verlangt jedoch das Fehlen von ‚regulären‘ Gräbern nach einer Erklärung, was mit den Leichnamen geschehen ist, die nicht

auf dem Schlachtfeld verblieben. Hier ist eine Entfleischung mit anschließender Verwahrung ausschließlich der größeren Knochen in einem Beinhaus ein durchaus denkbares Szenario. Bei weniger eindeutigen Befunden als derjenigen von Ribemont könnten folglich die menschlichen Skelettreste und Schädel sowohl von ‚feindlichen‘ Krieger*innen stammen wie auch von eigenen Angehörigen nach erfolgter Entfleischung. Die Quellen liefern also in diesem Fall ein „Überangebot“ an Erklärungsmöglichkeiten.

Die einseitige Konzentration auf eine Quellengattung — Schädel, sonstige Knochen, ‚reguläre‘ Gräber — mag eine schlüssige Erklärung für diese eine Gattung liefern, sie stellt sich aber als unzureichend oder zumindest nicht vollständig befriedigend heraus, wenn auch die anderen einbezogen werden. Neben der diachronen Perspektive wäre es selbstverständlich wünschenswert, auch regional stärker zu differenzieren, aber dazu scheint die Datenbasis derzeit noch zu klein bzw. noch nicht ausreichend aufgearbeitet.

AUSBLICK

Die Imputation fehlender Werte erlaubte die gleichzeitige Analyse von Datensätzen, die ansonsten nur bei einer Ausdünnung der Informationsdichte miteinander vergleichbar gewesen wären. Im extremen Fall hätte das bedeutet, lediglich das Vorkommen der größten Langknochen zu analysieren. Insofern ist das Vorschalten eines bayesschen log-linearen Modells für Kontingenztafeln vor eine Korrespondenzanalyse als nützliche Erweiterung des methodischen Werkzeugkoffers zu werten. Im Kontext der Ordinationsdiagramme der Korrespondenzanalyse ist ferner die Darstellungsform mit Kreditabilitätsellipsen nützlich, um „signifikante“ von weniger „signifikanten“ Positionierungen zu differenzieren. Die dafür notwendigen Daten werden mit den MCMC-Simulationen des bayesschen Modells gleich mitgeliefert.

Zur Lösung der offen gebliebenen Fragen wird die Erschließung weiterer Fundplätze aller Voraussicht nach nicht ausreichen, sondern künftige Forschungen

werden an den Knochen direkt ansetzen müssen. Zum einen wäre zu untersuchen, welche Behandlung die menschlichen Knochen durchlaufen haben, gerade auch im Vergleich zu Tierknochen (Bricking *et al.* 2025). Hier kämen insbesondere mögliche Schnitt- sowie Karnivoren- oder Nagetierspuren, aber auch histotaphonomische Analysen (*ibid.*) in Betracht. Wenn solche Informationen flächendeckend erhoben und zugänglich wären, könnten sie als weitere Dimension in die Korrespondenzanalyse einfließen (Macheridis 2017). Zum anderen müssten Isotopen- und aDNA-Analysen Fragen der Herkunft oder abweichenden Ernährungsgewohnheiten in den Blick nehmen, um ‚fremd‘ und ‚einheimisch‘ unterscheiden zu können.

Erst mit solchen zusätzlichen Informationen wird man hoffen können, ein besseres Verständnis der zahlreichen vereinzelt menschlichen Knochen von eisenzeitlichen Fundplätzen Mitteleuropas und darüber hinaus zu erreichen.

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Seashore Sites and Megaliths Along the Northeastern Skagerrak Coast

A Case of Egalitarian versus Hierarchic Ethos

Per Persson

KEYWORDS: genetic continuity, Funnel Beaker Culture, cultural dualism, social dynamics

Abstract

Recent ancient DNA research challenges the long-held view of genetic continuity from the Mesolithic to the Neolithic at coastal sites in Eastern Norway and on the Swedish west coast. Instead, findings reveal that individuals buried in Funnel Beaker culture megaliths in the region descended from farming immigrants from Central Europe, contradicting assumptions of local genetic continuity. However, these contrasting perspectives can be reconciled through the concept of cultural dualism in the Neolithic. According to this interpretation, local Mesolithic populations maintained their traditional fishing and hunting lifestyle while selectively adopting Neolithic artefacts such as pottery and polished flint axes.

This social persistence reflects a preference for egalitarian social structures, in line with the theory put

forward by social anthropologist Christopher Boehm, who suggests that humans have a genetic predisposition toward egalitarianism. This predisposition may have influenced the continued existence of hunter-gatherer societies after the beginning of the Neolithic, as their social organisation aligned more closely with this innate tendency than with the hierarchical structures indicated by megalithic graves, introduced by immigrant Funnel Beaker culture farmers.

By integrating material culture, subsistence economy, and genetic data, this paper examines the social dynamics and cultural identity of Neolithic Scandinavia, illustrating the coexistence of enduring indigenous egalitarian traditions alongside newly introduced hierarchical structures.

Zusammenfassung

Neuere aDNA-Untersuchungen stellen die lange Zeit angenommene Kontinuität der Bevölkerung vom Mesolithikum bis zum Neolithikum an den Küstenplätzen in Ostnorwegen und an der schwedischen Westküste in Frage. Stattdessen zeigen die Ergebnisse, dass die in den Megalithgräbern der Trichterbecherkultur bestatteten Individuen von Bauern aus Mitteleuropa abstammen, was gegen eine lokale genetische Kontinuität spricht. Dennoch lassen sich diese gegensätzlichen Perspektiven durch das Konzept des 'kulturellen Dualismus' im Neolithikum in Einklang bringen. Nach dieser Interpretation behielten die lokalen mesolithischen Gemeinschaften ihre traditionelle Lebensweise mit Fischerei und Jagd bei, während sie selektiv neolithische Artefakte wie Keramik und geschliffene Feuersteinäxte übernahmen. Der Fortbestand dieser Gruppen spiegelt eine Präferenz für egalitäre Gesellschaftsstrukturen

wider, die der Sozialanthropologe Christopher Boehm auf eine genetische Veranlagung zum Egalitarismus zurückführt. Diese Veranlagung könnte das Fortbestehen der Jäger- und Sammlergemeinschaften nach dem Beginn des Neolithikums beeinflusst haben, da ihre soziale Organisation besser mit dieser angeborenen Neigung harmonierte als eine Gesellschaft, die aufgrund der Existenz von Megalithgräbern als hierarchisch organisiert erscheint und von den Ackerbauern der Trichterbecherkultur eingeführt wurde. Durch die Integration von materieller Kultur, Subsistenzstrategien und genetischen Daten untersucht diese Arbeit die soziale Dynamik und kulturelle Identität im neolithischen Skandinavien und hebt die Koexistenz lang bestehender einheimischer egalitärer Traditionen neben neu eingeführten hierarchischen Strukturen hervor.

Sammanfattning

Senaste forskningen om gammalt DNA ifrågasätter den länge antagna befolkningskontinuiteten från mesolitikum till neolitikum på kustnära boplatser i östra Norge och på svenska västkusten. Istället visar resultaten att de som begravts i Trattbägarkulturens megaliter i området härstammade från jordbrukare som invandrat från Centraleuropa, vilket motsäger antaganden om lokal genetisk kontinuitet. Dock kan dessa motstridiga perspektiv förenas genom 'kulturell dualism' under neolitikum. Enligt denna tolkning behöll de lokala mesolitiska samhällena sin traditionella livsstil med fiske och jakt, samtidigt som de selektivt anammade neolitiska artefakter såsom keramik och slipade flintyxor. Samhällets fortbestånd speglar en preferens för egalitära sociala strukturer, som enligt socialantropologen Christopher Boehms

uppfattning, beror på att människor har en genetisk predisposition för egalitarism. En sådan predisposition kan ha medverkat till den fortsatta existensen av jägare-samlarsamhällen efter neolitikums början, eftersom jägar-samlares sociala organisation passat bättre med denna inneboende tendens än ett samhälle, som utifrån förekomsten av megalitgravar tycks ha haft en hierarkisk social organisation, och som kom med Trattbägarkulturens jordbrukare. Genom att integrera materiell kultur, försörjningsstrategier och genetiska data undersöks här den sociala dynamiken och kulturella identiteten i det neolitiska Skandinavien. Härigenom belyses långlivade inhemsk egalitära traditioner samexisterar med nyintroducerade hierarkiska strukturer.

INTRODUCTION

Pottery classified as belonging to the Funnel Beaker Culture (TRB) are found on the Neolithic seashore sites in the Oslofjord area, as are fragments of polished flint axes and transversal flint arrowheads. The flint axes are, in many cases, possible to determine as the thin-butted South Scandinavian type, and the transversal flint arrowheads are also found in South Scandinavian TRB. From these findings, it has been concluded that these sites belong to the TRB Culture. This determination has become problematic during the last decade as ancient DNA research has shown that those buried in megaliths typical for TRB are descendants of immigrants to Scandinavia, coming here due to the expansion of farmers from Middle Europe. The Early Neolithic seashore sites in the north-eastern (NE) Skagerrak area show a clear continuity backwards into the local Mesolithic, and it is unlikely that immigrants with a new culture inhabited them.

However, in the area, megaliths in the Middle Neolithic show the presence of descendants of immigrant TRB farmers. Therefore, there are two types of Funnel Beaker Culture in the area, one consisting of local Mesolithic folks continuing their traditional way of life, adding pottery and polished flint axes to their artefact inventories, and another with immigrant farmers. The seashore sites exhibit continuous occupation throughout the Middle Neolithic, with findings attributed to the Pitted Ware Culture (PWC). Remarkably, this demonstrates that local communities with Mesolithic ancestry maintained their traditional way of life for over 1,500 years following the introduction of agriculture in nearby regions. The preference for a Mesolithic way of life is likely rooted in an inherent universal human preference for egalitarian social conditions that were less demanding to combine with fishing and hunting sea mammals than an agrarian subsistence.

MESOLITHIC-NEOLITHIC CONTINUITY ON SEASHORE SITES

The area in focus here is the coast in the NE Skagerrak area (Fig. 1). This area is rich in seashore Stone Age settlement sites, dating from c. 9500 to 2350 BCE. Megalithic graves of the dolmen and passage grave types built in the Middle Neolithic are found along the Swedish West Coast and in the Oslofjord area (Fig. 1). The area has a considerable land uplift; in the northernmost part, i.e., north in the Oslofjord, the earliest Mesolithic shore sites are situated close to 200 m above the present sea level (Eymundsson 2015), while the Early Neolithic starts at c. 40 m (Mjærørum 2009; Mansrud

and Jaksland 2018) and at the beginning of the Late Neolithic the sea stood 23 m higher than today. This land upheaval gives the relative chronologically ordered sites according to their height, an early recognised archaeological advantage (Brøgger 1905; Alin 1925). The terrain is mostly rocky and steep. Sites were established at places favourable for activity related to subsistence and communication. They were situated on the beach, at relatively flat, soil-covered land when such emerged from the sea. Later, due to land upheaval, these places were abandoned as the site became so far

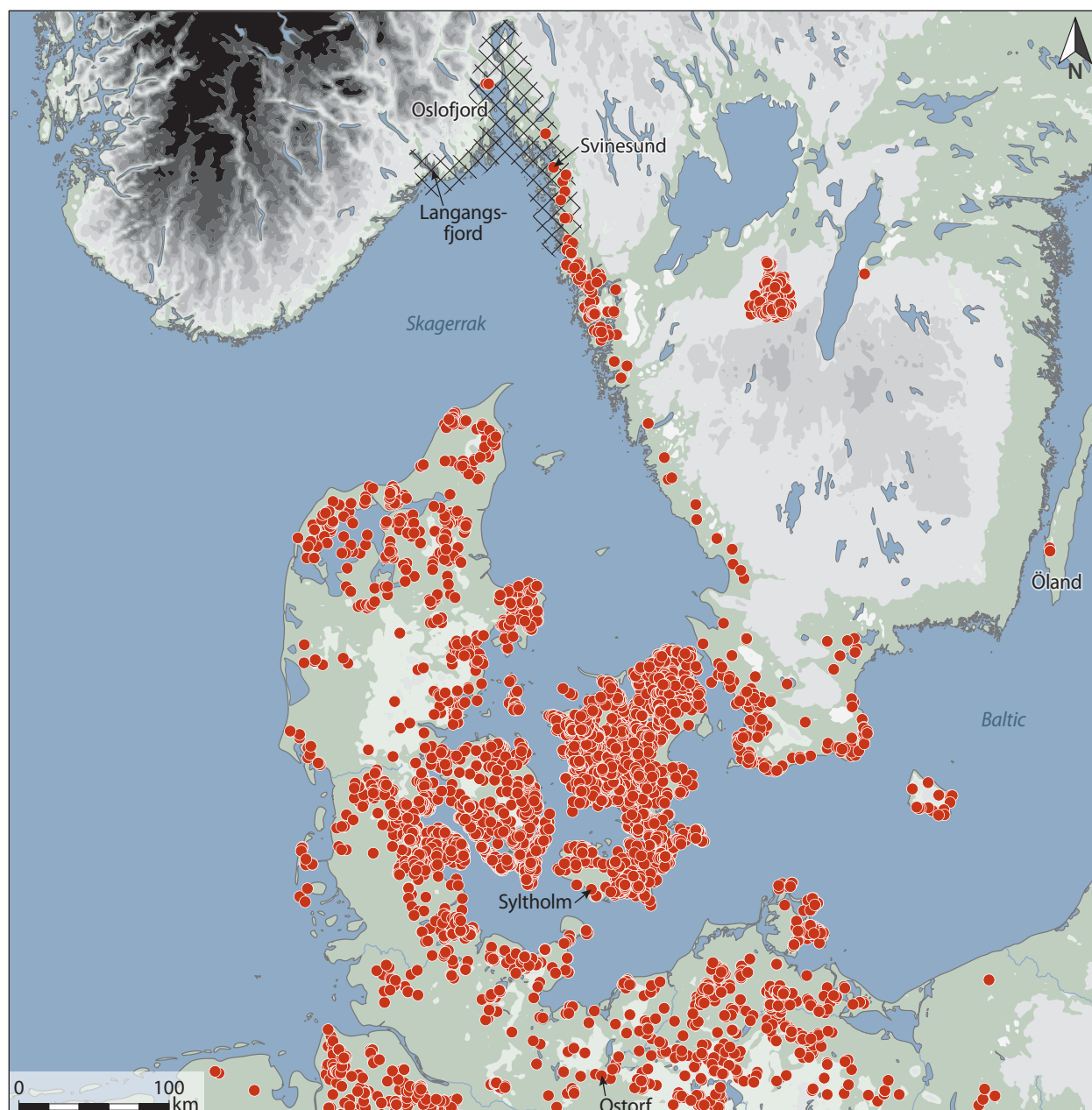


Fig. 1. NE Skagerrak area (grey cross-hatching) and other mentioned place names on a map showing megalithic graves in northern Europe. The map is a part of the map in Barbara Fritsch *et al.* 2010 with corrections on the Swedish West Coast and in Norway (Map: Per Persson; revised by Karin Winter).

away from the seashore that establishing a new site at a lower spot became more practical. The chronological span for such sites varies due to the topography in the surroundings and dating of the site; the land uplift was most significant in the Early Mesolithic and gradually diminished after that. At the Late Mesolithic Vassum site, 12 radiocarbon dates show that the site was used for 400 years (Rosenvinge *et al.* 2022b). This span might be typical, but just a few sites have as many radiocarbon dates as this could be evaluated.

Bone preservation is poor on archaeological sites in the NE Skagerrak area, but there are sites with burned bones and some shell middens with unburned bones. Compilations of the Mesolithic and Neolithic bone finds show fishing, fowling, and hunting of sea and land mammals (Damlien *et al.* 2021, 104–106; Jonsson 1995; 2007; Hufthammer 1997). ^{13}C stable isotopes from human skeletons from seashore sites in the area confirm a heavy dependence on marine resources (Lidén 1995; Skar *et al.* 2016; Sjögren and Ahlström 2016; Boethius

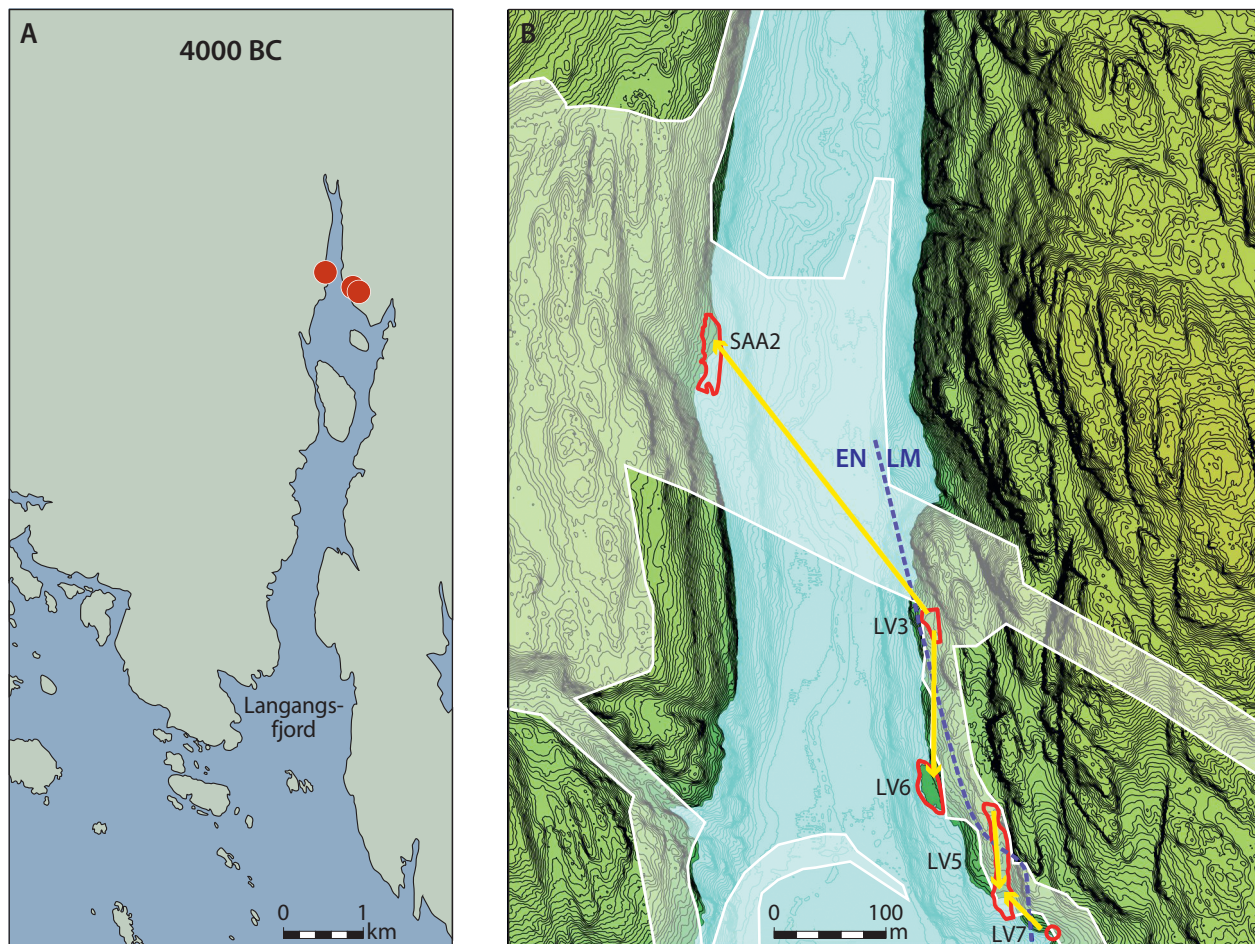


Fig. 2. The Mesolithic – Neolithic transition at the Langangsfjord. **A** Overview. Sea level set to 30 m, excavated Early Neolithic sites are marked; **B** excavated sites from the Mesolithic Neolithic transition phase; the **yellow arrows** show the chronological order of the sites; the **blue dotted line** separate Late Mesolithic (LM) and Early Neolithic (EN) sites. The LV3, LV7 and northern part of LV5 sites are Late Mesolithic, the LV6, SAA2 and the lower southern part of LV5 is Early Neolithic. The sea level is set to an Early Neolithic level of 28 m. The excavation was carried out in connection with the building of a new railway bridge, a **white line** shows the area affected of the building activity (Maps: Per Persson; revised by Karin Winter).

and Ahlström 2018). Besides dogs that appear on several sites, there is just one find of each sheep and cattle bone directly dated to the Neolithic (Strinnholm 2001). Even though bone finds are rare, the similar localisation for both Mesolithic and Neolithic sites, at the shore surrounded by rocky and steep terrain, is likely due to their having the same focus on fishing and hunting.

Hundreds of Stone Age sites have been excavated in land development projects in the NE Skagerrak area (cf. Damlien *et al.* 2021). These sites show that there has been a continuous use of seashore throughout all of Mesolithic and well into the Neolithic, dropping at c. 2500 BCE and disappearing during the Late Neolithic (Solheim and Persson 2018, 341). Given that these coastal sites span a 7,000-year period, only a few are likely to date to the Mesolithic-Neolithic transition. However, some sites have been identified, showing that finds from the higher elevation at the site are from

Late Mesolithic, while finds from the lower parts of the same site belong to the Early Neolithic. An example is the Langangen Vestgård 5 site, where the higher part of the site has radiocarbon dated 4700–4375 BCE and the lower 3950–3650 BCE (Reitan 2014). The land uplift changed the terrain; therefore, small areas like single sites are not likely to have been used the same way over thousands of years. A broader definition of a place as a particular terrain element, as a fjord or a strait, several kilometres in size, is more suitable to show the long-time continuity. Such a continuity could be illustrated by the Langangen Vestgård 5 site mentioned above, situated at the Langangen fjord. This fjord was formed when the sea stood 100 m higher and still exists. Most of the land is rocks and steep terrain, but archaeological surveys have shown that Stone Age sites are found at all suitable spots along the former fjord shores. Fishing is most likely to be the main activity from these

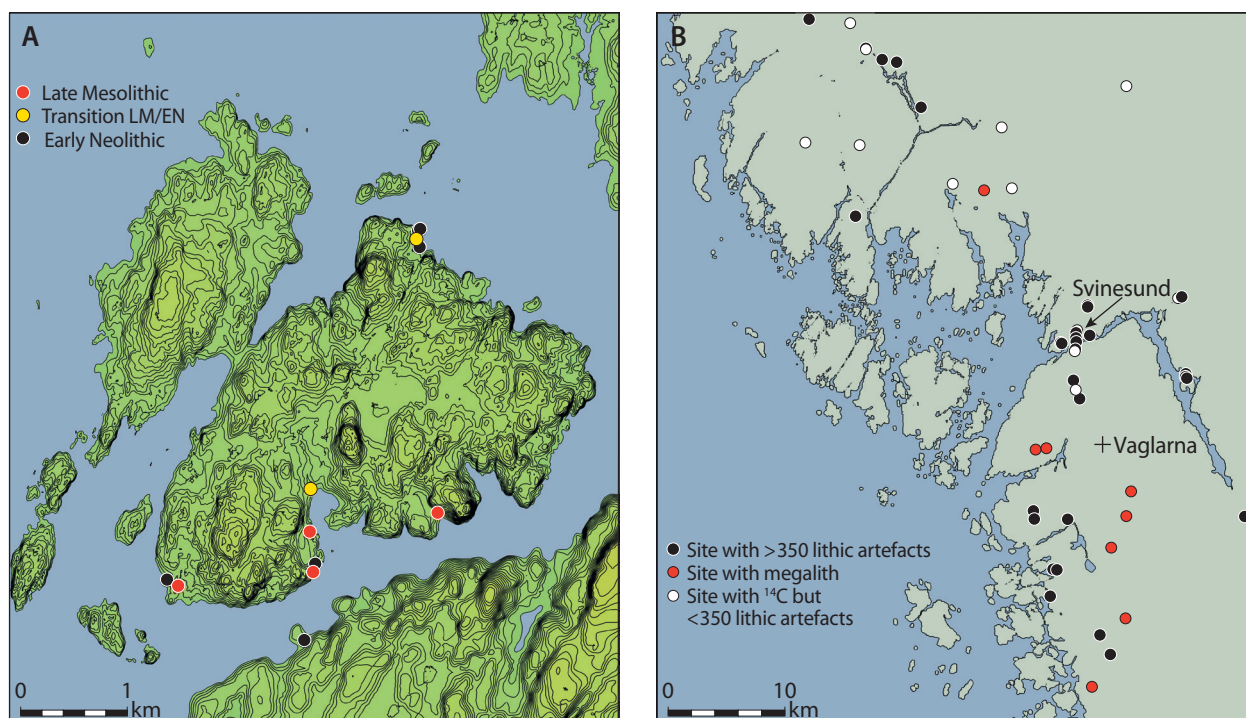


Fig. 3. **A** Excavated sites from the Mesolithic Neolithic transition at the Svinesund island at 35 m sea level; **B** excavated sites dated between 5000 and 2350 BCE, used for investigating relation to the sea at the time of settlement and artifact composition on the sites. The map has present day sea level. Sites with radiocarbon dates are those that have dates 5000–2350 BCE but less than 350 finds of lithic artifacts. Sites with >350 lithic artifacts are all seashore sites, dated by radiocarbon or sea level. Lake Vaglarna is the place for the shoreline displacement curve after Tore Pässe (2003) (Maps: Per Persson; revised by Karin Winter).

sites. In connection with the building of railway and motorway bridges, 15 Stone Age sites have been excavated at the shore of the former fjord, dating from 7500 to 3700 BCE (Melvold and Persson 2014; Reitan and Persson 2014; Granados 2022; Reitan 2023a; 2023b; Reitan and Øynebråten 2023). Figure 2 shows the five excavated sites at the fjord dated to the transition from Late Mesolithic to Early Neolithic.

Nearly all archaeology along the NE Skagerrak coast is due to land development; therefore, excavating several sites in the same surroundings that show place continuity is rare. The Langangsfjord, just mentioned, is one example; another is Svinesund, where a new motorway was built at the beginning of this century (Glørstad 2004b). During the Stone Age, this was an island a few kilometres across. The construction works affected Stone Age sites between 55 and 33 m above present sea level at the island's northern and southern shore. The highest sites were Mesolithic, while the lowest were Early Neolithic. The continuity from Late Mesolithic to Early Neolithic is shown at Svinesund in that sites from both periods have the same type of location even though they have been moved a few hundred meters due to local topography and the land uplift (Fig. 3A).

The Svinesund excavations show the continuity from Mesolithic into Early Neolithic. However, due to

the limitations set by the construction works, no later Neolithic site was investigated in that project. Similar seashore sites dating to the Middle Neolithic are known along the coast further away from Svinesund. To get a representative view of the entire Neolithic, the excavated sites from the coast 30 km north and 30 km south of Svinesund have been compiled in figure 3B (cf. Solberg 2009; 2012). In this area, it has been possible to determine the height from information in the excavation reports for 35 excavated Stone Age sites with at least 350 lithic finds. These sites cover the end of the Mesolithic, from 5000 BCE, the Early Neolithic, starting at 3900 BCE in this area, up to the onset of the Late Neolithic, 2350 BCE. 17 of these sites have radiocarbon dates of the Stone Age activity, the rest of the sites can be dated by shoreline displacement. In addition to radiocarbon datings from these sites, the investigation includes radiocarbon dates in the relevant time span from archaeological excavations on sites with less than 350 lithic finds, mostly Late Neolithic, Bronze- and Iron Age settlement sites excavated with a technique other than the one used on the seashore Stone Age sites. This compilation gives a total of 63 radiocarbon dates for which the height of the findspot could be determined.

Shoreline dating is a well-established method in the NE Skagerrak area. The core of the method is the shoreline displacement curves produced by quaternary geology. Such curves are constructed for a particular spot; the one used here is valid for the small lake Vaglarna in northern Bohuslän, marked in figure 3B (Påsse 2003). The curve has to be recalculated to be used at another place. An alternative way to compensate for the difference in shoreline displacement at different places is to adjust the height of the sites so that it is equivalent to the contemporary height at that place; Svinesund is used here as such a reference place. The Vaglarna curve is moved to Svinesund following the principles used by Tore Påsse (2003).

The shoreline displacement curve shows the find-spot's height over the sea at the time given by the radiocarbon date (Fig. 4). Most finds are between 0 and 10 m over the sea; the median is 4 m. These results confirm that the sites have been situated at the seashore when in use (for more details on the method used, see Fossum 2020; Rosenvinge *et al.* 2022a; Persson *in press*).

The distribution of the radiocarbon dates from the sites is not even. However, the number of dates considered here is far too low to draw any secured conclusions about variation in settlement intensity. There are two apparent biases in the selection of samples in this area: One is the many dates to the Early Neolithic, explained by the eagerness to date this phase in the Svinesund project, and the other bias is the many dates after 3000 BCE that have been aimed for to date typical Pitted Ware Culture sites. If this is taken into account and considering that sites without radiocarbon datings fill the gaps, the most likely conclusion is that the seashores have been used with the same intensity from 5000 to 2350 BCE.

All the 35 excavated sites, having more than 350 lithic finds, are likely to have been situated on the seashore when in use. The 17 sites with radiocarbon dates confirm this. The chronological span is 5000 to 2350 BCE, equivalent to a height from 42 to 19 m above present sea level at Svinesund. The sites were situated a few meters above sea level when they were in use, as mentioned, on average 4 m. Assuming this is more or less the same for all sites, a likely chronological order could be established from the site's height. Hereby, it is possible to establish the occurrence of several lead artefacts in the site sequence (Fig. 5). These sites cannot be considered as close finds, and the aim here is not to date the individual types but rather to show that the finds confirm the constant use of seashore sites with gradual changes without any noticeable break in the sequence.

The local sequences at the Langangsfjord and Svinesund, as well as the compilation of excavated sites in the area around Svinesund, all show continuous use of seashore sites from the Mesolithic up to the start of Late Neolithic 2350 BCE. This continuity is likely due to local people continuing their traditional way of life and using these sites accordingly. aDNA investigations also confirm this continuity.

Seven Mesolithic individuals from the NE Skagerrak coast have published genetic results (Günther *et al.* 2018; Kashuba *et al.* 2019; Allentoft *et al.* 2024a, b). They are all grouped with other Mesolithic individuals from Scandinavia. All but one individual from Evensås in Bohuslän are dated before 5000 BCE (Appendix 1–3). There are three dates on the human bones from Evensås, spanning 4230–3100 BCE (Nordqvist 2000; Ahlström and Sjögren 2009). Osteological investigations have shown that this find includes bones from two individuals (Sjögren and Ahlström 2016). Workers collected the bones in 1930, and the site has not been excavated. The dating carried out most recently is on the aDNA-investigated individual showed a Late Mesolithic date, 4232–3982 BCE (AAR-11206, 5259 ± 37 BP). Stable isotope measurements show a significant dependence on marine food. The date, therefore, needs a correction for the marine reservoir effect. One determination of this effect on the Norwegian coast is 300 years (Bondevik *et al.* 2006). From the “deep pit” trench at the Huseby klev Mesolithic site (Nordqvist 2005; Kashuba *et al.* 2019), there are many radiocarbon dates on material with and without marine reservoir effect. Comparing the median ages for the two groups of dates gives a reservoir effect value of 450 years; although this is somewhat imprecise, it is the only archaeological observation of the reservoir effect from the NE Skagerrak area. If 300 years is used as a likely minimum value for the reservoir effect, the aDNA investigated individual from Evensås will be dated 3899–3646 BCE, thereby showing this individual with Mesolithic ancestry was living in the Early Neolithic. Evensås is also a seashore settlement site known by surface collection of both Mesolithic and Neolithic finds (Johansson 1974).

Combined with the continuity in the use of seashore sites from Mesolithic time into the Neolithic, shown above, the Mesolithic ancestry of the Evensås man and his pronounced marine diet, as well as buried on a seashore site that had been in use over the Mesolithic-Neolithic transition, clearly shows that the indigenous Mesolithic population continued their traditional way of life into the Neolithic.

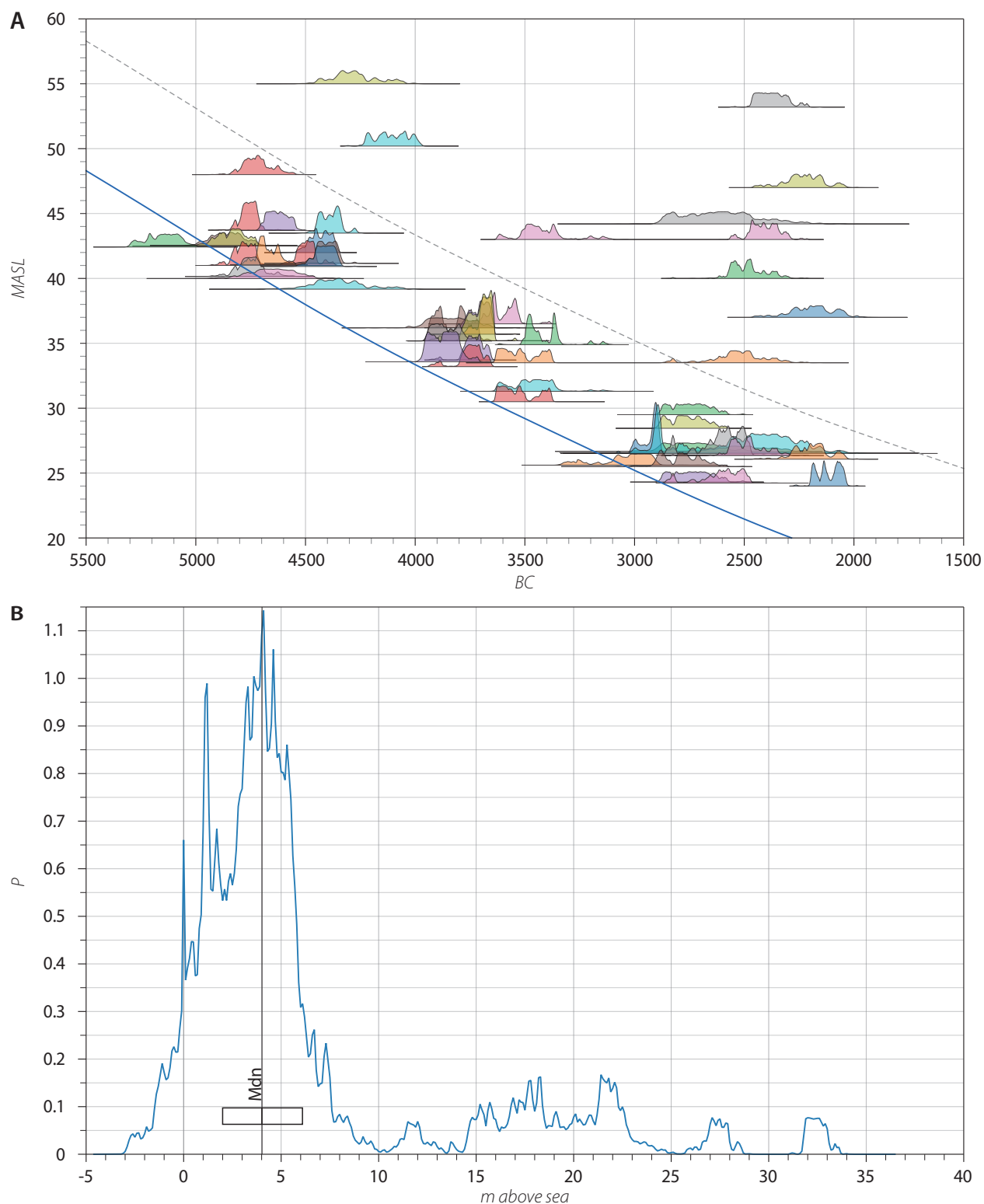


Fig. 4. A Radiocarbon datings from archaeological excavations in the area shown in figure 3.B. The blue line is the shoreline displacement curve from Vaglarna (Påsse 2003), moved to Svinesund according to the principles used by Tore Påsse. The dotted grey line is 10 m over the sea. Each radiocarbon date is represented by its probability density curve and placed at the height at Svinesund for the time given by the dates. There are 63 radiocarbon dates. The colour is random and just for to distinguish the individual dates. B The sum probability density curves for the 63 radiocarbon dates, redrawn as probability for height over the sea at the time given by the radiocarbon date (for details on the method: Persson in press). Median, first and third quartiles are shown as a box. The median height for all 63 dates is 4 m over the sea at the time given by the radiocarbon date.

and most likely agricultural, diet (Persson 2023a, 91 fig. 7). Already from these isotopic results it was very likely that the buried were of EEF ancestry (Persson 2023a) just as all investigated individuals dated before 2800 BCE found in megaliths in Sweden and Denmark (Bedoya 2018; Sánchez-Quinto *et al.* 2019; Malmström *et al.* 2019; McKenna *et al.* 2022; Ausmees *et al.* 2022; Al-lentoft *et al.* 2024a, b). Lately this has been confirmed as two of the individuals were part of an aDNA investigation (Seersholm *et al.* 2024).

We have many seashore fishing and hunting sites rich in finds, while settlements dated before 2350 BCE that could be associated with agricultural subsistence and therefore situated further away from the seashores are few both around the Oslofjord and along the west

coast of Sweden (cf. Persson 1991; 2023a Sjögren 2003; Johansson 2004). This discrepancy does not mean that the population that used the seashore sites was more numerous than those buried in the megaliths. Several circumstances give quite plausible reasons why agricultural sites might have escaped the archaeologists' attention to a much higher degree than the seashore sites. One such circumstance is that seashore sites, to a significant extent, were established on land that remained uncultivated. In contrast, agricultural Stone Age sites have been situated close to arable land and, therefore, are more likely to have been destroyed by agricultural use during the following thousands of years (cf. Malmer 1969).

CULTURAL DUALISM

The idea of a cultural dualism in Scandinavian Neolithic was first formulated by Oscar Almgren (1914) as one of several possible explanations for why hunting and fishing sites from the Neolithic were found in Eastern Middle Sweden, despite agriculture being known to have been practised according to finds from megalithic graves (Almgren 1906). The dualism term alludes to periods with more than one contemporary culture close to each other during the Stone Age. The problem was formulated for the relationship between a 'Settlement Culture' (*östsvensk boplatskultur*) and a 'Megalithic Grave Culture' (*megalitkultur*). In the 1950ies, these cultures were renamed Pit Ware (PWC) and Funnel Beaker Culture (TBC), respectively (Becker 1951). Almgren contrasted the dualistic view with a monistic one. The most common version of the monistic view claimed that there has not been any immigration in the Neolithic, farming being introduced as a cultural transfer, and the Neolithic PWC hunter and fisher site along the Baltic coast being the result of a de-neolithisation as farming was phase-out after Early Neolithic (cf. Persson 2023a).

The long-lasting debate on the relationship between TRB and PWC in East Sweden seems now to be solved by aDNA and stable isotope investigations (Fraser 2018; Fraser *et al.* 2018; Sánchez-Quinto *et al.* 2019; Persson 2023a). On the island of Gotland, there is limestone bedrock, and because of this, bones are well preserved. There is one megalith and many PWC flat graves known on the island. The genetics show that those buried in the megalith had the same EEF ancestry as those buried in megaliths on mainland Sweden. In contrast, those buried in the PWC graves had their closest relatives among Mesolithic individuals from the island and the Mesolithic Motala site on the mainland (Coutinho *et al.*

2020). Even though TRB and PWC populations lived close to each other, they were different in ancestry and subsistence.

The TRB and PWC phenomena are the same on the NE Skagerrak coast as in East Sweden. However, there is an archaeological advantage in investigating the settlement continuity on the NE Skagerrak coast compared to East Sweden. In the main areas of PWC research in East Sweden, the coast around and south of Stockholm and the islands of Öland and Gotland do not have a continuous land uplift; instead, there were periods with sea rise and land drowning during the Late Mesolithic and Neolithic in the Baltic (Berglund *et al.* 2005; Risberg *et al.* 2005; Strandberg *et al.* 2020); resulting in gaps in the sequence of seashore sites. Even if it is not possible to follow the whole chronological sequence as it is in the NE Skagerrak area, the PWC ceramic tradition in East Sweden can be traced back to TRB in the classical sequence of shoreline-dated sites at Säter and Fagervik (Bagge 1951). Judging from the NE Skagerrak coast knowledge, this fits well with the continuous use of seashore sites from the Mesolithic until the onset of the Late Neolithic. Just like in the NE Skagerrak area, it is not likely that immigrant farmers have replaced the indigenous population on those seashore sites. Such continuity also explains the similarity between Mesolithic and PWC genetics despite the >2000-year gap between the aDNA-investigated individuals from respective groups. Moreover, the genetics of those buried in the megalith on Gotland show that descendants from EEF immigrants were living near the seashore sites. This strengthens the assumption that those buried in the megaliths on the NE Skagerrak coast also share this genetics.

Cultural dualism during the Neolithic has not only been observed in NE Skagerrak and Eastern Sweden. In Denmark, the Lola girl known from DNA in an Early Neolithic “chewing gum” from Syltholm is a well-known example of typical Mesolithic ancestry persisting into the Neolithic (Jensen *et al.* 2019). The Syltholm site is dated from Late Mesolithic 4700 BCE to Early Neolithic (Philippsen 2018; Jensen *et al.* 2019). The site's character is typical for Danish Mesolithic seashore sites, with fishing traps directly dated to the Neolithic being among the most prominent findings at the excavation (Terkelsen 2017; Philippsen 2018). Despite the Mesolithic ancestry and the subsistence being based on hunting and fishing, there are, just as on the seashore sites in the NE Skagerrak area, TRB pottery and polished flint axes on the Syltholm site.

EGALITARIAN SOCIETIES

Most researchers concerned with the subject have argued that the megaliths show a hierarchic social structure (cf. research overview in Sørensen 2020). The megaliths on the Swedish West Coast do not provide much direct argument for this. Just one of them has preserved human bone, and little is known about the settlements where the buried lived. However, the mere existence of megaliths alongside nearby societies with Mesolithic roots and subsistence based on fishing and hunting, gives an indirect insight.

The reason for establishing a cultural dualism is not a general cultural conservatism among Mesolithic folk. Along the NE Skagerrak coast, as well as at Syltholm and Ostorf, people of Mesolithic descent adopted TRB pottery and polished flint axes. Along the NE Skagerrak coast, these novelties did appear *ca.* 3900 BCE, *i.e.* as early as in South Scandinavia. Conservatism is instead concerned with the way of life, subsistence economy, and, as genetic mixing is rare, marriage and family life.

Christopher Boehm (1999) divides cultures into those having an egalitarian and those having a hierarchic ethos. The ethos term, used by Christopher Boehm, is from social anthropology and refers to the underlying attitudes, values, and beliefs that shape a culture or society (Sahlins 1976). We humans share the hierarchic behaviours with our closest relatives among the great apes. These behaviours include the eagerness to dominate others for one's winnings and a tendency to become subservient to avoid reprisals. Both behaviours have become part of the primate genetic legacy as they are promoted in natural selection. They give a genetic ground a hierarchic group structure. According to Christopher Boehm, an egalitarian ethos is unique for humans and characterised as striving to

Another similar case is the Ostorf grave field in North Germany (Schuldt 1962). The graves dated *c.* 3300 to 2900 BCE (Olsen and Heinemeier 2009) show many similarities with Mesolithic graves, and the subsistence has mainly been based on fishing (Lübke *et al.* 2009). Genetic investigations of the buried have shown them to be of Mesolithic descent (Posth *et al.* 2023). Both TRB pottery and polished flint axes are found in the Ostorf graves.

Last but not least, in South Scandinavia, Mesolithic people lived their traditional lives in the vicinity of Neolithic farmers for more than 1000 years up to 4000 BCE, when agriculture was established in Middle Europe and appeared up to the southern coast of the Baltic (Zvelebil and Rowley-Conwy 1984; Persson 1999).

counteract the hierarchic tendencies in groups; oppression is therefore not always met with obedience but breeds resistance. This striving comes from a genetically founded altruism among humans. As altruism does not favour its bearer in an individual natural selection, its existence is due to a group selection that has been on hunter-gatherer bands throughout tens of thousands of years. Bands with a higher proportion of generous, unselfish members had a higher probability of survival, and due to this, tendencies towards altruism could become inherited.

If Christopher Boehm's reasoning is accepted, we can see the differences between the two poles in Neolithic cultural dualism, representing societies with egalitarian and hierarchic ethos. There has been much cultural variability among Mesolithic groups surviving into Neolithic over a waste area and a prolonged period. However, cultural variation is delimited by and highly associated with the organisation of a subsistence economy. The Mesolithic subsistence and a strive for egalitarian social conditions as part of the human genetics legacy show that the egalitarian ethos was a common characteristic of all the different Mesolithic cultures involved.

If striving for egalitarian social conditions is a part of the human genetics legacy, as Christopher Boehm proposes, it is hard to explain how hierarchic societies could ever evolve. However, in northern Europe, the hierarchic Neolithic societies came from abroad as fully developed. No transition from egalitarian to hierarchic needed to have taken place here. The transition from egalitarian to hierarchic societies might be very rare. However, when it occurred, it led to an expanding society with a hierarchic structure that gave economic and military superiority.

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APPENDIX

Appendix 1 (double page, continued on the following pages). Late Mesolithic and Neolithic settlement sites included in this study. These sites are marked with black dots on figure 3B. The sites are in chronological order with Rørbekk 1 being the earliest and Dafter the youngest. Sites listed in rows with a green background are dated using shoreline chronology, while those in rows with a white background are dated by a combination of shoreline and radiocarbon. The shoreline dating is based on the height at

Site	UTM zone 32N, Easting	UTM zone 32N, Northing	Distance from Svinesund, m	Height, m a.s.l.	Correction factor, m/km	Contemporary height at Svinesund, m.a.s.l.	Lowest elevation	Mean elevation	Transversal arrowhead	One edged arrowhead	Arrowhead of A-type	Arrowhead of types B, C or D	Arrowhead made of slate	Handle core, for microblades	Cylindrical blade core	Mikrochip	Polished flint axe, fragments
Rørbekk 1	628950	6553275	234	42.0–44.0	0.00	42.0–44.0	42.0	43.0	1					2		287	1
Gåshult I, lower	629270	6548010	4164	42.0–43.0	0.13	42.5–43.5	42.0	43.0	3		1			1+	*	*	*
Smedveien 9	627732	6552772	809	42.0–43.0	0.00	42.0–43.0	42.0	42.5								8	
Skråtorp	606000	6580668	12482	42.0–46.0	-0.13	40.0–44.0	40.0	42.0						5		838	
Svinesund m	630137	6553449	978		0.00	41.0–43.0	41.0	42.0								41	
Finstad	610880	6578180	12768	43.5	-0.12	42.0	42.0	42.0	1	2	1					200	1
Utne R34	612281	6577201	12620	42.3–43.2	-0.13	40.6–41.6	40.6	41.1						1		148	
Berget 2	628960	6553670	581		0.00	39.0–43.0	39.0	41.0	13							59	2
Torpum 13	628980	6552900	74		0.00	39.4–42.5	39.4	41.0	10	1	1			5		1000	
Haldenproj., Lok. 5	638055	6556770	7814	43.6–40.1	-0.12	39.0–42.5	39.0	40.8	34					4		258	6
Vestgård 8	629940	6555995	3085		-0.10	39.0–40.0	39.0	39.5	25					1		114	
Børstad R52/53	613524	6576976	13047	38.0–39.0	-0.10	36.7–37.7	36.7	37.2	2							4	
Torpum 10	629000	6552975	0		0.00	36.0–37.5	36.0	36.8	86	31	3					103	1
Sponvika	627630	6552830	810		0.00	36.0–37.0	36.0	36.5	10		1						
Ystehedeneset	638506	6549776	1982		0.00	35.0–36.0	35.0	35.5	20								
Vestgård 6 felt 1	629955	6556070	3157		-0.10	35.0–37.0	35.0	36.0	284	130	21					178	28+

Appendix 2. Megalithic graves included in this study. These are the graves marked with red dots on figure 3B. The three lowest graves were located on the sea shore during their period of use.

Megalith graves	UTM zone 32N, Eastling	UTM zone 32N, Northing	Distance from Svinesund (m)	Height (m a.s.l.)	Correction factor (m/km)	Contemporary height at Svine- sund (m a.s.l.)
Olskär, Skee 173	631994	6535189	13906	29	0.06	30.0
Skjeltorp	621060	6565940	7258	31	-0.06	30.5
Hessland, Lur 43	630328	6523210	25113	30	0.06	31.5
Kjämpastenarna, Hogdal 100	625492	6543623	9853	35	0.06	35.5
Kitteröd, Skee 740	633697	6540037	8856	39	0.06	39.5
Kampetorp, Skee 506	633228	6529092	18569	40	0.06	41.0
Skjuleröd, Hogdal 111	626408	6543743	9291	43	0.06	43.5
Masselberg, Skee 147	633291	6537910	10901	46	0.06	46.5

Svinesund. For sites further away from Svinesund the distance is measured perpendicular to the isobase that in this area this is considered to be E-W with a 30-degree deviation towards SE. This correction follows Tore Påsse (2003). Four excavated sites in the area have not been included in the table; Liskekasberget, omr. 1–3 (Munkenberg 2007) as the height of these sites are not possible to deduct from the report, and Neanberg (Westergaard 2009), with less than 350 lithic finds.

Neol. Ceramic, no. shards	Stone Axe of Nøstvet-/ Lihult-types	Other type of stone axe	Flakes from stone axe manufacturing	Total number of finds, stone	Shoreline date (BCE)	No. of radiocarbon dates from when the site was at the beach	Radiocarbon date (BCE)	Literature	Comments
	2		85	3750	5100–4900	0		Jaksland 2003a	
*	*	1	*	*	4900	1	5001–4716	Schaller Åhrberg 2006a; 2006b	Finds are not specified to “lower” or “higher” part of the site
			15	587	5000–4900	0		Holen 2023	
	1		6	10409	5000–4600	3	4800–4550	Hårstad 2023	
		2	3	814	5000–4850	0		Persson 2023b	
		1	1	3046	4750–4500	0		Melvold 2004; Melvold 2009	
		1		994	4700–4600	0		Berg 1996	
49		2	19	4000	5000–4600	0		Tørhaug 2002	
	4	2	105	25000	5050–4750	2	4489–4261	Jaksland 2003b	
		2+	186	30000	5000–4600	7	4588–4052	Hafting 2007	
43		1	140	7500	4700–4600	0		Johansen 2004b	
				379	4300–4100	0		Berg 1996	
		1	2	11600	4450–4300	1	3709–3385	Glørstad 2003	
			0	2059	4450–4300	0		Bjørkli and Persson 2021	
				1597	4300–4100	0		Skullerud 2014	
242		4	4	28600	4450–4200	2	3950–3659	Jaksland and Tørhaug 2004	

Site	UTM zone 32N, Easting	UTM zone 32N, Northing	Distance from Svinesund, m	Height, m a.s.l.	Correction factor, m/km	Contemporary height at Svinesund, m.a.s.l.	Lowest elevation	Mean elevation	Transversal arrowhead	One edged arrowhead	Arrowhead of A-type	Arrowhead of types B, C or D	Arrowhead made of slate	Handle core, for microblades	Cylindrical blade core	Mikrochip	Polished flint axe, fragments
Vestgård 3	629965	6555915	3028		-0.10	33.0–35.0	33.0	34.0	85	21	7					47	3
Vestgård 6 felt 2	629955	6556070	3157		-0.10	33.0–35.0	33.0	34.0	174	16	6			1		75	3
Opstad Vest lok. 7	615628	6573101	10743	34.0–35.0	-0.10	33.0–34.0	33.0	33.5	23	7	1					20	
Bjällvarpet 2	628900	6552270	660		0.00	33.0–34.0	33.0	33.5	40	21	3					1	5
Ystehede	638390	6549900	2031	33.0–34.0	-0.10	33.0–34.0	33.0	33.5	90	56	10					21	2+
Värmlandsbro V	628248	6537623	13671	30.0	0,07	31.0	31.0	31.0			14				7		1
Skaveröd, Hogdal 315 och 39	628743	6549588	3061	31.0	0.10	31.0	31.0		2	1							5
Skee 1811, Lillespissen	626980	6533330	18023	28.0	0.07	29.5	29.0	30.0			44				33		2
Värmlandsbro Ö	628248	6537623	13671	28.0	0.07	29.0	29.0	29.0			19				10		6
Solbakken 3	638409	6550152	2259		-0.10	28.5–29.5	28.5	29.0		1	68	1	*		22		31
Kråkerøy B (tuft 3)	609995	6563710	205	27.0–28.0	0.00	27.0–28.0	27.0	27.5				x			1		2
Berby	643490	6537860	5844	27.0–29.0	-0.07	26.5–28.5	26.5	27.5			36				41		x
Ånneröd	625299	6538350	14516	25.0–26.0	0.06	26.0–27.0	26.0	26.5			19	26	5				12
Skee 54	627309	6533260	17919	25.5	0.06	26.5	26.5	26.5			2	3	2				2
Skee 45	625377	6537642	15090	24.5	0.06	25.5	25.5	25.5			2	5					1
Kråkerøy A (tuft 1+2)	609995	6563710	205	25.0–27.0	0.00	25.0–27.0	25.0	26.0				x	5				11
Sandhem	631015	6527670	20907	25.0	0.06	25.0	25.0	25.0				6	6				
Dafter	626746	6531001	20157	23.0	0.06	24.0	24.0	24.0			1	8	15				4

Appendix 3 (double page, continued on the following pages). Radiocarbon dates included in this study. These dates are used both for dating the sites listed in Table 1 and for assessing the elevation of the findspot relative to sea level at the time indicated,

	UTM zone 32N				Radiocarbon		std.
	Eastling	Northing	Dist. from Svinesund (m)	Correction factor (m/km)	Lab. no.	Age BP	
Skråtorp	606000	6580668	12482	-0.13	Ua-75042	5820	32
Skråtorp	606000	6580668	12482	-0.13	Ua-75045	5888	32
Skråtorp	606000	6580668	12482	-0.13	Ua-75048	5774	31
Haldenproj., Lok. 5	638055	6556770	7814	-0.15	TO-1849	6200	50
Haldenproj., Lok. 5	638055	6556770	7814	-0.12	T-8816	5510	105
Haldenproj., Lok. 5	638055	6556770	7814	-0.12	TO-1859	5560	50
Haldenproj., Lok. 5	638055	6556770	7814	-0.12	TO-1852	5580	50
Haldenproj., Lok. 5	638055	6556770	7814	-0.13	T-8806	5795	90
Haldenproj., Lok. 5	638055	6556770	7814	-0.13	TO-1854	5880	50
Haldenproj., Lok. 5	638055	6556770	7814	-0.14	TO-1856	5950	50
Torpum 13	628980	6552900	74	-0.12	TUa-3845	5530	50
Torpum 13	628980	6552900	74	-0.12	TUa-4390	5610	40
Torpum 10	629000	6552975	0	-0.09	TUa-4003	4830	50
Vestgård 6 felt 1	629955	6556070	3157	-0.10	TUa-4315	4965	40
Vestgård 6 felt 1	629955	6556070	3157	-0.10	TUa-4389	5020	45

Neol. Ceramic, no. shards	Stone Axe of Nøstvet-/Lihult-types	Other type of stone axe	Flakes from stone axe manufacturing	Total number of finds, stone	Shoreline date (BCE)	No. of radiocarbon dates from when the site was at the beach	Radiocarbon date (BCE)	Literature	Comments
267		2	19	19800	4200–4000	1	3891–3643	Johansen 2004a	
30		1	6	16800	4200–4000	6	3766–3539	Jaksland and Tørhaug 2004	
				2020	4100–3900	0		Havstein and Danielsen 2023	
16	1		1	4374	4050–3950	2	4000–3700	Johansson 2006	
31			3	16373	4100–3900	2	3600–2300	Olstad 1993, Solheim 2012	
51				2980	3500–3250	0		Thorsberg and Hernek 2005; Munkenberg 2007	
800				424		1	3637–3196	Johansson 2004	number of pottery not specified, but should be ca. double the flint no.
				3864	3300	0		Johansson 2017	
4				4730	3500–3250	0		Thorsberg and Hernek 2005; Munkenberg 2007	
648				13185	3500–3400	1	2900–2600	Østmo 2007	Spear head of slate
450					3350	0		Johansen 2000	
					3550–3300	0		Bjørkli 2020	
1051		2		3543	3000	4	2900–2450	Strinnholm 2001	
34					3000	5	2900–2200	Toreld 2005	
16				2323	3000	2	3100–2700	Claesson 2016	
520				2630	3350	0		Johansen 2000	
270					2900	1	2300–2000	Hernek et al. 2004	
157				5430	2650	3	2800–2000	Fredsjo 1949; Strinnholm 2001	

as shown in figure 4. The height used is that at Svinesund, see Appendix 1 caption.

Height			Cal			Comments	Literature
m a.s.l.		Contemp. at Svinesund, m.a.s.l.	min. 96%	median	max. 96%		
42.70		41.06	4785	4681	4552		Hårstad 2023
45.40		43.72	4839	4759	4695		Hårstad 2023
45.30		43.69	4710	4628	4543		Hårstad 2023
43.60		42.42	5302	5138	5007		Hafting 2007
40.10		39.17	4588	4357	4052		Hafting 2007
42.10		41.16	4499	4402	4331		Hafting 2007
41.86		40.92	4532	4412	4340		Hafting 2007
41.00		39.99	4884	4646	4448		Hafting 2007
41.20		40.15	4895	4752	4610		Hafting 2007
43.60		42.53	4983	4829	4714		Hafting 2007
43.50		43.49	4489	4384	4261		Jaksland 2003b
42.00		41.99	4536	4426	4354		Jaksland 2003b
36.50		36.50	3709	3590	3385		Glørstad 2003
33.50		33.20	3931	3734	3646		Jaksland & Tørhaug 2004
35.50		35.19	3950	3815	3659		Jaksland & Tørhaug 2004

	UTM zone 32N				Radiocarbon		
	Eastling	Northing	Dist. from Svinesund (m)	Correction factor (m/km)	Lab. no.	Age BP	std.
Vestgård 6 felt 1	629955	6556070	3157	-0.10	TUa-4388	5045	35
Vestgård 3	629965	6555915	3028	-0.10	TUa-4242	4955	35
Vestgård 6 felt 2	629955	6556070	3157	-0.09	TUa-4243	4885	35
Vestgård 6 felt 2	629955	6556070	3157	-0.09	TUa-4244	4905	35
Vestgård 6 felt 2	629955	6556070	3157	-0.09	TUa-4408	4930	40
Vestgård 6 felt 2	629955	6556070	3157	-0.10	TUa-4386	4965	35
Vestgård 6 felt 2	629955	6556070	3157	-0.10	TUa-4387	5020	35
Vestgård 6 felt 2	629955	6556070	3157	-0.10	TUa-4405	5045	85
Bjällvarpet 2	628900	6552270	660	0.10	Ua-26788	5095	45
Bjällvarpet 2	628900	6552270	660	0.10	Ua-26789	5055	45
Solbakken 3	638409	6550152	2259	-0.07	TUa-3801	4180	50
Ånneröd	625299	6538350	14516	0.06	GrA-15123	3970	50
Ånneröd	625299	6538350	14516	0.06	GrA-15113	4050	50
Ånneröd	625299	6538350	14516	0.06	GrA-15125	4050	50
Ånneröd	625299	6538350	14516	0.07	Ua-26852	4270	45
Ånneröd	625299	6538350	14516	0.07	Ua-26851	4300	40
Skee 54	627309	6533260	17919	0.06	a**	3925	120
Skee 54	627309	6533260	17919	0.06	T-15705	3930	110
Skee 54	627309	6533260	17919	0.06	T-15706	3985	110
Skee 54	627309	6533260	17919	0.06	T-15708	3930	100
Skee 54	627309	6533260	17919	0.07	T-15707	4170	85
Skee 45	625377	6537642	15090	0.07	Ua-3734	4220	60
Skee 45	625377	6537642	15090	0.07	Ua-3735	4380	65
Sandhem	631015	6527670	20907	0.05	Ua-26747	3770	45
Dafter	626746	6531001	20157	0.07	GrA-15124	4150	50
Dafter	626746	6531001	20157	0.05	GrA-14141	3725	25
Dafter	626746	6531001	20157	0.06	GrA-14139	4050	50
Ystehede	638390	6549900	2031	0.01	T-10031	3995	70
Ystehede	638390	6549900	2031	0.01	b**	4735	50
Gåshult I, lower	629270	6548010	4164	0.13	Ua-26343	5970	60
Skaveröd	628743	6549588	3061	0.10	Ua-26187	4675	70
Bjällvarpet 1	628860	6552100	660	0.13	Ua-26437	5855	50
Borge Østre	609532	6580340	13964	-0.06	TUa-5002	3890	40
Borgen mellom	622560	6571360	12701	-0.06	T-18022	4000	110
Borgen mellom	622560	6571360	12701	-0.06	T-19009	4110	90
E6 lok. 27	623440	6566120	8603	-0.07	TUa-5670	4160	50
Finstad	610880	6578100	12768	-0.06	TUa-5034	3925	40
Halden lok 1	637740	6556670	7814	-0.12	T-8811	5450	85
Hunn Mitt	618360	6566500	3060	-0.06	T-15101	3970	50
Hyllan, Skaveröd II	628940	6548770	3671	0.09	Ua-26474	4635	60
Kolberg søndre	605670	6570050	3122	-0.12	Ua-46179	5665	40
Kolberg søndre	605670	6570050	3122	-0.14	Ua-46197	5910	37
Rørmyr I	633288	6574915	21144	-0.08	T-322	4480	80
Stensröd	629075	6553925	0		TUa-3895	3790	50
Torpum 9	628940	6553100	0		TUa-3921	5270	45
Vestgård 6	629955	6556070	3157		TUa-4407	3765	60
Veum søndre	610347	6569834	5273	-0.09	Tua-7945	4740	45
Neanberg	631910	6525990	21914	0.09	Ua-26850	4615	40

* uncertain height ** Lab. no. is not published

Height		Cal			Comments	Literature
m a.s.l.		Contemp. at Svinesund, m.a.s.l.	min. 96%	median	max. 96%	
35.50		35.18	3955	3867	3714	Jaksland & Tørhaug 2004
34.00		33.71	3891	3721	3646	Johansen 2004a
35.50		35.20	3766	3674	3539	Jaksland & Tørhaug 2004
36.00		35.70	3769	3686	3637	Jaksland & Tørhaug 2004
36.50		36.20	3786	3700	3641	Jaksland & Tørhaug 2004
35.50		35.20	3903	3732	3647	Jaksland & Tørhaug 2004
35.50		35.19	3946	3818	3708	Jaksland & Tørhaug 2004
36.50		36.19	3986	3838	3648	Jaksland & Tørhaug 2004
33.50	*	33.57	3983	3869	3781	Johansson 2006
33.50	*	33.57	3962	3861	3712	Johansson 2006
28.60	*	28.45	2896	2762	2586	Østmo 2007
25.50		26.35	2621	2485	2298	Strinnholm 2001
25.50		26.38	2858	2587	2466	Strinnholm 2002
25.50		26.38	2858	2587	2466	Strinnholm 2003
25.50		26.51	3017	2893	2698	Nordqvist & Jonsson 2009
25.50		26.52	3025	2914	2787	Nordqvist & Jonsson 2009
25.50		26.51	2864	2411	2041	Nordell & Swedberg 2003
25.50		26.51	2859	2416	2055	Nordell & Swedberg 2003
25.50		26.56	2872	2508	2203	Nordell & Swedberg 2003
25.50		26.51	2852	2414	2137	Nordell & Swedberg 2003
25.50		26.67	2918	2742	2491	Nordell & Swedberg 2003
24.50		25.50	2923	2786	2584	Claesson 2015
24.50		25.61	3331	3024	2890	Claesson 2015
25.00		26.07	2341	2190	2034	Hernek <i>et al.</i> 2004
23.00		24.31	2882	2739	2581	Strinnholm 2001
23.00		24.00	2201	2114	2035	Strinnholm 2001
23.00		24.23	2858	2587	2466	Strinnholm 2001
33.50		33.50	2855	2522	2291	Olstad 1993
33.50		33.50	3635	3524	3375	Solheim 2012
42.00		42.50	5001	4716	4857	Schaller-Åhrberg 2006a,b
31.00		31.30	3637	3196	3460	Johansson & Lindman 2002
48.00		48.00	4840	4722	4553	Johansson 2006
54.00		53.20	2470	2374	2209	c. 100 finds Johansson 2006
45.00		44.20	2876	2531	2207	<100 flint Grindkaså 2003
45.00		44.20	2889	2687	2470	<100 flint Grindkaså 2003
30.00		29.5	2886	2748	2582	<100 flint Vikshåland <i>et al.</i> 2007
43.50		43.00	2566	2408	2290	Site is also Mesolithic Melvold 2009
56.00		55.00	4452	4285	4052	Mesolithic >5000 BC Olstad 1990
40.00		40.00	2621	2485	2298	Bronze Age excavation, Mesolithic and Neolithic finds not reported Melheim <i>et al.</i> 2016
43.00		43.00	3627	3440	3109	No finds Thorsberg 2006
41.00		41.00	4606	4495	4368	No finds Sharpe 2014
41.00		41.00	4896	4779	4704	No finds Sharpe 2014
155.00		153.00	3366	3177	2925	Also mesolithic >5000 BC Moberg 1963
47.00		47.00	2452	2226	2039	Also mesolithic >5000 BC Glørstad 2003
50.20		50.20	4239	4114	3982	Also mesolithic >5000 BC Glørstad 2003
37.00		37.00	2451	2185	1981	Site is also Early Neolithic Jaksland & Tørhaug 2004
31.00		30.50	3635	3533	3376	c. 100 finds Dahl & Nybruget 2010
33.00	*	34.89	3521	3445	3137	33 finds? Westergaard 2009

Going North – Two Migrants in Neolithic Scandinavia

Karl-Göran Sjögren, Malou Blank

KEYWORDS: Funnel Beaker Culture, Neolithic, mobility, isotopes

Abstract

This paper is an attempt to describe the long-distance journeys of two Funnel Beaker individuals found in the province of Västergötland, Western Sweden. Human mobility research, enabled by the development of bioarchaeological methods, has become an important tool for the understanding of prehistoric societies. In Southern Sweden, the geological structure and available baselines are favourable for relatively detailed mobility investigations combining strontium and oxygen

isotopes. The data suggests that both of the individuals originated from the southernmost part of Sweden, but their remains were found about 350 km further north. Both finds are unusual. One is an Early Neolithic bog find, probably connected to an early wave of migration northwards, whereas the other is an Early/Middle Neolithic young male who died after a series of relocations. He was buried, but his bones were disinterred 1000 years later to be reburied in a Late Neolithic gallery grave.

Zusammenfassung

Dieser Artikel beleuchtet, die weiträumigen Reisen zweier Individuen der Trichterbecherkultur, die in der Provinz Västergötland im Westen Schwedens gefunden wurden. Die Erforschung der Mobilität des Menschen, die durch die Entwicklung bioarchäologischer Methoden ermöglicht wird, ist zu einem wichtigen Instrument zum Verständnis prähistorischer Gesellschaften geworden. In Südschweden sind die geologischen Strukturen und die verfügbaren Referenzwerte günstig für relativ detaillierte Mobilitätsuntersuchungen, bei denen Strontium- und Sauerstoffisotope kombiniert werden. Die Daten deuten darauf hin, dass beide Individuen aus dem

südlichsten Teil Schwedens stammten, ihre Überreste jedoch etwa 350 km weiter nördlich gefunden wurden. Beide Funde sind ungewöhnlich. Der eine Fund, der wahrscheinlich mit einer frühen Migrationswelle nach Norden in Verbindung steht, datiert ins frühe Neolithikum während der andere ein junger Mann aus dem frühen/mittleren Neolithikum ist, der nach einer Reihe von Ortswechseln verstarb. Er wurde begraben, aber seine Knochen wurden 1000 Jahre später exhumiert, um in einem Galeriegrab aus dem späten Neolithikum erneut bestattet zu werden.

Sammanfattning

Denna artikel diskuterar de långväga resor som förete sig av två individer från trättbägartid som hittats i Västergötland, västra Sverige. Forskning om mänsklig rörlighet har blivit ett viktigt verktyg för förståelsen av förhistoriska samhällen, något som möjliggjorts av utvecklingen av bioarkeologiska metoder. I södra Sverige är de geologiska förhållandena, tillsammans med kännedom om bakgrundsdata, gynnsamma för att studera mänsklig rörlighet med hjälp av strontium- och syreisotoper. Våra data tyder på

att båda personerna härstammar från den sydligaste delen av Sverige, men deras kvarlevor hittades cirka 350 kilometer längre norrut, på Falbygden respektive Kinnekulle. Båda fynden är ovanliga; den ena är en ung kvinna, offrad i en våtmark och troligen kopplad till en tidig migrationsväg norrut. Den andra är en ung man från tidig-/mellanneolitisk tid som dog efter en rad flyttningar, begravdes på okänd plats, men fick sina ben upptagna 1000 år senare för att begravas igen i en senneolitisk hällkista på Kinnekulle.

BACKGROUND

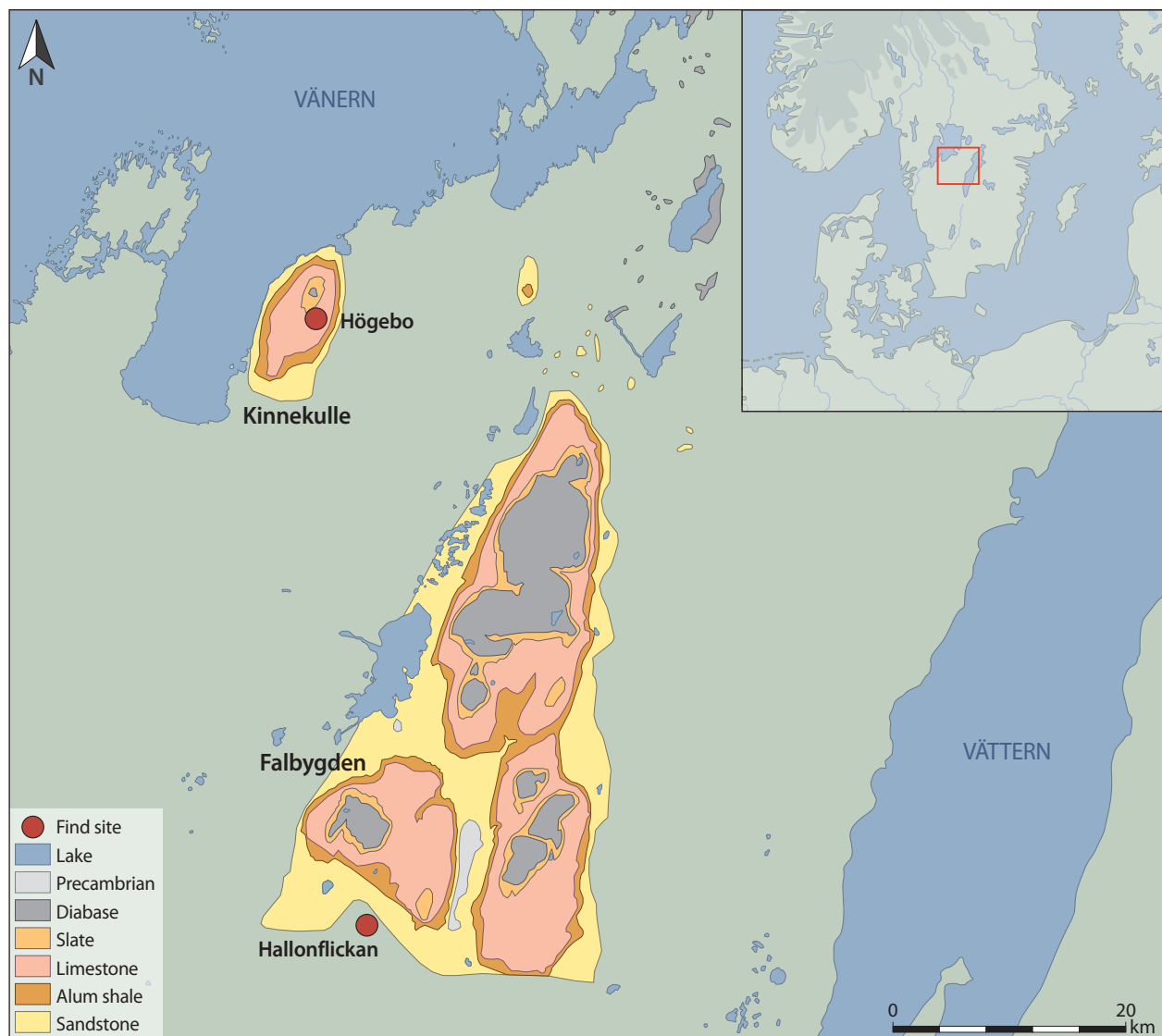


Fig. 1. Map of the two sites discussed in the text, with simplified bedrock of the area (Graphic: Malou Blank, maps: Karin Winter).

In this paper, we will present and discuss two cases of long-distance movement from the Funnel Beaker (TRB) period in Sweden. Both have their origin in southern Scandinavia, probably in Scania, but their skeletal remains were found some 350 km further north in the province of Västergötland in western Sweden. The broad outlines of their travels can be traced by isotopic analyses, in this case a combination of strontium (Sr) and oxygen isotopes.

In recent years, the study of human mobility has seen something of a breakthrough with the employment of bioarchaeological methods. Most common has been the use of strontium isotopes, but also oxygen, sulphur and lead isotopes have sometimes been tested. In many cases, however, results have been limited

to the identification of a number of “non-local” individuals. The meaning of this term varies from site to site, as a result of different geological spatial patterning but also due to differing density and extent of baseline sampling. Further complicating factors are the geographically uneven knowledge of baseline values and the existence of multiple regions with overlapping baseline values. The group of “locals” may therefore include misclassified non-local individuals, and any attempt at determining the origin of non-local individuals becomes challenging.

Therefore, credible identifications of long-distance movers have been rare. For an interesting case of a Middle Neolithic Danish male with a chequered life history, coming from the north, see Anders Fischer

etal. (2024). In this paper, we discuss two such cases that have recently been identified, the bog find of the so-called Hallonflickan (the Raspberry girl) and a young adult male found in a gallery grave at Högebo (Sjögren *etal.* 2017; Blank *etal.* 2023). Both sites are in the province of Västergötland in western Sweden

THE HÖGEBÖ MALE

In 1886, Carl Hippolyt Nyström excavated and removed a gallery grave at Högebo, Österplana parish on Kinnekulle, at the request of his brother-in-law, Fredrik Skjöldebrand (Nyström 1886). It was discovered in 1885 and left open over winter, after which Carl Hippolyt Nyström returned in the summer and collected the

(Fig. 1). Both finds also derive from areas of calcareous sedimentary bedrock surrounded by much older Precambrian rocks. This has contributed to their preservation but also give the find sites distinctive Sr isotope signals, quite different from the Precambrian regions (Sjögren *etal.* 2009; Blank *etal.* 2018; Blank *etal.* 2021).

skulls, some long bones, and the porthole slab (SHM 7881). In 1917, a mandible and five bone needles were donated to the Statens Historiska Museum (SHM) by his son, Gunnar Nyström (SHM 15944) and a further bone needle was donated in 1921 by one of the workers employed at the excavation (SHM 16679). Apparently, it broke when he found it and he did not dare to give it to Carl Nyström.

The grave was dug into the ground and consisted of a 4.0x1.4 m large rectangular chamber constructed by limestone slabs. The grave was divided by a slab with an oval port-hole into a chamber and an open antechamber in the west-southwestern end (Fig. 2; Nyström 1886; Sahlström 1915 no. 234). Based on the architecture, the grave belongs to a west Swedish group of gallery graves with portholes and antechambers. Such graves mainly date to the Late Neolithic (c. 2200–1700 cal BC), although cases of earlier dates have been published (Blank *etal.* 2020; Blank 2021).

According to Carl Nyström (1886), skeletal remains from about 50 individuals were found, along with a flint dagger, 6 bone needles and some flints. He described the skeletons as well preserved and partially articulated, placed in sitting positions against the chamber walls. In particular, he noted that some skulls still had the mandibles attached. However, in the drawing by Fredrik Skjöldebrand (Fig. 2), the skeletons are placed in supine positions and only seven skeletons are depicted. The illustration cannot be considered to depict an accurate placement of the bones and is probably a misunderstanding by Fredrik Skjöldebrand.

Only 25 skulls are stored at SHM, since Hans Hildebrand (the National Antiquarian) only wanted the skulls and the porthole slab to be sent to Stockholm. Carl Nyström had a doctoral degree in zoology as well as a licentiate degree in medicine, and could identify the bone elements. His estimate of the number of individuals was based on femur bones of which he identified 84. Assuming that some femora were lost or unidentified led him to the number of 50 individuals, which is a quite reasonable estimate, and one of the very few MNI (Minimum Number of Individuals) estimates made at this time. He also looked for signs of trauma and diseases but only found one case of periostitis in a humerus.

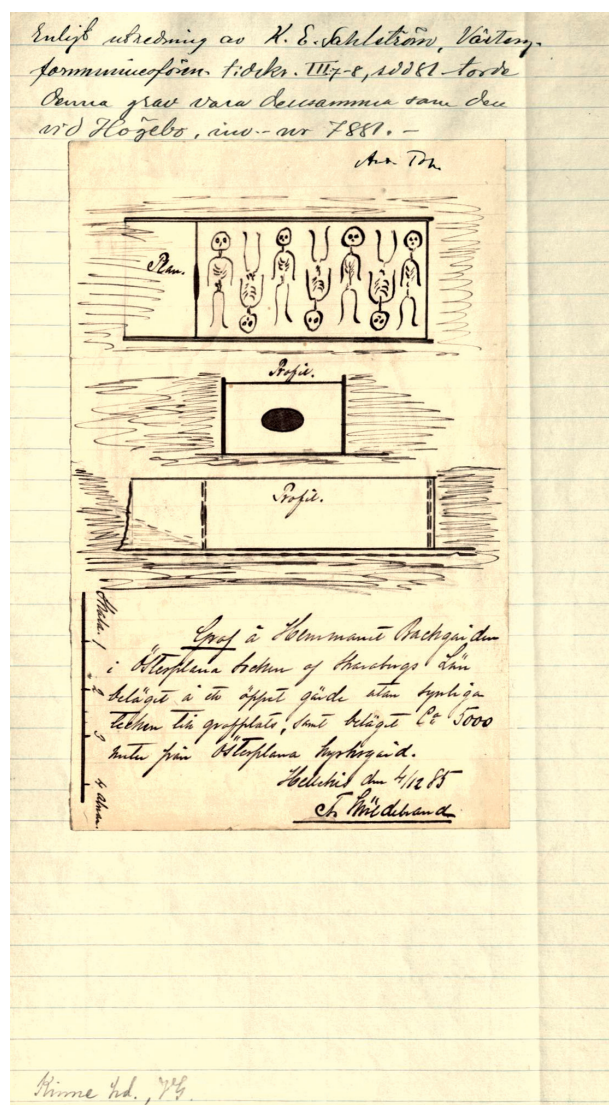


Fig. 2. Sketch drawing of the Högebo grave by Fredrik Skjöldebrand in December 1885 (Antikvarisk-Topografiska Arkivet, Stockholm).

Another interesting observation was made by a local stoneworker, who could identify the particular layer of limestone the chamber slabs had been taken from. According to him, such limestone was accessible in the vicinity of Österplana church, 1 km to the east of the site.

Data from three individuals were published by Malou Blank *et al.* (2023). From the individual of interest here, a mandible with M1–M3 teeth was dated and analysed for aDNA, collagen and enamel isotopes. The aDNA confirmed male sex. Based on the attrition of the teeth, the mandible was determined as a male *c.* 17–25 years old at death.

HALLONFLICKAN (THE RASPBERRY GIRL)

This skeleton was discovered in May 1943 during peat digging in the Rogestorp bog, part of a large bog complex called Mönarps mosse (SHM 20559). A preliminary report was published by Axel Bagge (1947) and a more detailed account by Nils-Gustav Gejvall *et al.* (1952). The find was also discussed by Torbjörn Ahlström and Sabine Sten (1995) and by Peter Jankav (2011). A detailed re-examination was published by Karl-Göran Sjögren *et al.* (2017).

The skeleton was determined to be a young girl, probably 18–19 years old at death. A concentration of raspberry seeds in the stomach region suggests she died in late summer. Histological analysis of her bones indicates that she was deposited in water at or very shortly after her death and has since been undisturbed. This is corroborated by analysis of freshwater molluscs and pollen analysis, suggesting an environment of shallow water, varying by season.

The osteologist Elias Dahr, who did the first examination of the find, concluded that Hallonflickan had been lying on her stomach, and he noted that the lower legs were extremely flexed. He therefore suggested that the feet had been tied up against the back of the femurs. Both lower arms were found below the pelvis. Whether the arms had also been tied could not be established, although this remains a possibility. No signs of trauma were visible on the skeleton, and the cause of death remains unclear. No remains of rope or clothing were

The male was surprisingly dated to the Funnel Beaker period, 3500–3110 calBC (95.4%) while the two other individuals dated to 1880–1660 calBC (*i.e.* Scandinavian Late Neolithic), which can be expected of burials in gallery graves (Blank *et al.* 2020).

A few similar examples of Early and Middle Neolithic datings of human remains are known in gallery graves from the Falbygden area, some 30 km to the south of Kinnekulle (Blank *et al.* 2020). There are several possible explanations for this early date. The mandible might indicate a first burial phase of the grave, although deposition of an old bone in the grave during the Late Neolithic is probably more likely.

noted, although this may be suggested based on the integrity of the body. Figure 3 shows an interpretation of how the body may have been positioned. Axel Bagge suggested that she had been bound and sacrificed or executed (Bagge 1947). Similar suggestions were made by Torbjörn Ahlström and Sabine Sten (1995) and by Karl-Göran Sjögren *et al.* (2017).

The Early Neolithic date of Hallonflickan (see below) makes her the earliest example of a Neolithic individual in western Sweden, and sets here in the context of a large group of similar finds from southern Scandinavia, usually interpreted as human sacrifices. Such finds in wetlands are common in the period *c.* 4000–3000 calBC, after which they decrease in number (Koch 1998; Sjögren *et al.* 2017; van Beek *et al.* 2023).

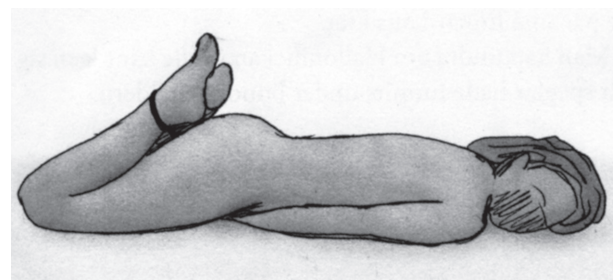


Fig. 3. Interpretation of the body position of Hallonflickan (after Sjögren *et al.* 2017, 106 fig. 8).

DATINGS AND DIET

Datings and collagen isotopes of the two individuals are shown in table 1. For Hallonflickan, two previous dates have been published, suggesting a Middle Neolithic date. Here, the most recent date is used, as it is considered more reliable (Sjögren *et al.* 2017). C/N ratios suggest well preserved collagen as they are within

the accepted range 2.9–3.6 (van Klinken 1999). $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values for both individuals suggest terrestrial protein sources with little or no contribution from freshwater or marine foods, and consequently negligible reservoir effect on the dates.

Calibrations are plotted in figure 4. Hallonflickan can be dated to the first part of the Early Neolithic (ENI, 4000–3500 cal BC). The most likely date is 3804–3644 cal BC (88.4%) although there is a small probability peak around 3900 cal BC also. The calibrated range of the Högebo male is much wider, due to the shape

of the calibration curve in this segment. Three quite diverse peaks point to possible dates at around 3450, 3350 and 3200 cal BC. The first two peaks fall in the Early Neolithic (ENII 3500–3300 cal BC) while the last one falls in the early Middle Neolithic (MNA 3300–2800 cal BC).

Table 1. Datings, carbon and nitrogen isotope values (Data from Sjögren *et al.* 2017 and Blank *et al.* 2023).

Site	Element	Lab.no.	BP uncal.	1s	BC cal., 1s	BC cal., 2s	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	C/N	Sex	Age
Högebo (MP3)	M1 mand dxt	UBA-28120	4583	36	3491–3141	3503–3104	–20.0	10.6	3.15	male	17–25
Hallonflickan	femur sin	UBA-30518	4962	42	3777–3655	3932–3644	–20.6	8.4	3.24	female	18–19

The collagen values of Hallonflickan derive from her left femur and reflect an average of her protein intake over a number of years before death, primarily her teenage. The $\delta^{13}\text{C}$ value is normal for Scandinavian Funnel Beaker Culture (TRB), indicating mainly terrestrial protein sources. The $\delta^{15}\text{N}$ value is unusually low compared to Middle Neolithic individuals from passage graves but is similar to other Early Neolithic individuals, suggesting a trend of rising $\delta^{15}\text{N}$ in humans during the Funnel Beaker period (Sjögren *et al.* 2017; Sjögren *et al.* 2023). The explanation may be sought in lower consumption of animal foods during the Early Neolithic, in less intensive agriculture (lower

amounts of manure), or a combination. In any case the value is consistent with a high proportion of plant foods (Sjögren 2017).

For the Högebo male, we have collagen values from the root of his right upper first molar. The root of this tooth forms in early years, starting when the crown is formed (*i.e.* at *c.* 3–4 years) and continuing up to the age of 9–10 years. In most cases, breastfeeding should not affect these values. Both $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ are similar to values from passage graves and can be interpreted as resulting from a terrestrial diet with a high plant food consumption (Sjögren 2017).

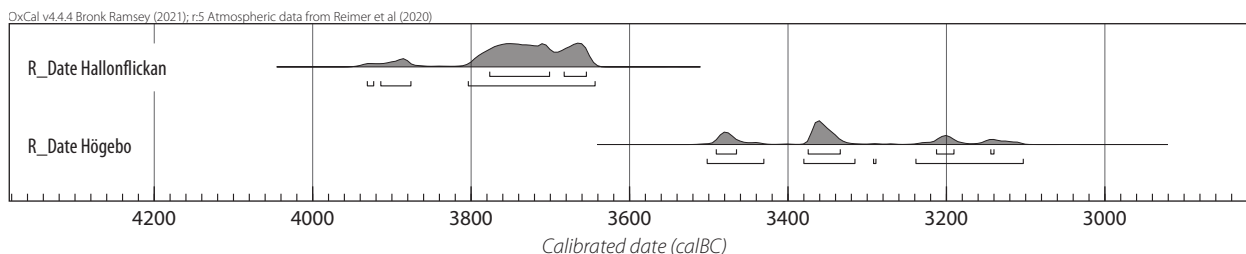


Fig 4. Calibration plot of the datings (Graphic: Malou Blank with Oxcal v4.4, Intcal20).

THE JOURNEYS

Three molar teeth from the Högebo male were sampled for Sr isotope analysis, enabling us to trace movements during his childhood and early adolescence as the enamel of these teeth forms at different times (Table 2; Nelson and Ash 2010; Hillson 2014). His first molar tooth, crystallizing at the age of 0–3.5 years, yielded a rather low Sr isotope ratio (0.7110). Such values do not occur in most of the Scandinavian peninsula but can be found in parts of Scania, possibly also in a narrow stretch along the Swedish west coast (Klassen *et al.* 2020; Ladegaard-Pedersen *et al.* 2021). Denmark is unlikely as an origin as baseline values are generally below

0.711 (Frei and Frei 2011), although small areas with higher values can occasionally be found (Klassen *et al.* 2020). A slightly higher (0.7115) Sr isotope ratio was measured in his second molar, representing the age of *c.* 4–7 years.

His third molar, which mineralized between the age of around 9 and 14 years, yielded a much higher ratio (0.7224) indicating that sometime after the age of seven years he must have moved to an environment with higher bioavailable Sr isotope ratios. The bioavailable Sr isotope ratios at Kinnekulle, where he was buried, do not match this ratio. At Kinnekulle the Sr isotopes

range between 0.714 and 0.719 (Blank *et al.* 2018; Blank *et al.* 2023). This suggests another move, after the formation of the M3 tooth, but not very much later as he died before the age of 25. Ratios around 0.722 can be found in the surrounding areas of inland western Sweden (Blank *et al.* 2018), but also in several other regions in southern Sweden. Areas in eastern Sweden are excluded, however, since baseline values there are generally higher or much higher.

Oxygen isotopes ($\delta^{18}\text{O}$) in mammals reflect the isotope composition of ingested water (Bryant *et al.* 1996). The isotopes are sensitive to environmental and biological processes and depend on factors such as temperature, distance from ocean, precipitation intensity and elevation (Chenery *et al.* 2012; Lightfoot and O'Connell 2016). No major climatic events are known from this time period, but short-term variations cannot be completely excluded. Other factors such as cooking, brewing, breastfeeding, and the intake of dairy products can alter the oxygen isotopes towards increased values (Lin *et al.* 2003; Brettell *et al.* 2012; Chinique de Armas *et al.* 2022).

The oxygen isotope levels from the first molar falls within the range of values from other Neolithic Scania individuals. It should be noted, however, that oxygen isotopes are not very informative at this scale, as they do not vary very much between southern and western Sweden, and there is a large degree of overlap (Fig. 5).

The oxygen value of his second molar is more than 1‰ lower, suggesting he lived in colder conditions. Such a value is only known from one Neolithic individual, found in Scania but with a different Sr isotope signal. The low Sr isotope is compatible with living in some part of Scania, but possibly in a more inland region. It is

possible that the higher oxygen isotope value in the first molar is affected by breastfeeding. However, it cannot explain the lower values in the third molar.

In the M3 tooth we find an even lower value, suggesting much colder conditions. Such values are not known from any of the measured individuals from southern or western Sweden. Taken together with the high Sr isotope value, this suggests a quite drastic change in living environment, and consequently suggests a long-distance movement in his juvenile years, likely to a more northerly region. Unfortunately, lack of baseline data from areas to the north of Västergötland impedes any attempt to pinpoint where this might be. His final resting place at Kinnekulle is outside the isotopic range for both the Sr and O values in his M3 tooth, suggesting that as a young adult he returned further south.

For Hallonflickan we only have isotopic data from the first molar, the crown of which forms at the age of 0–3.5 years (Table 2, Fig. 5). The values are very similar to those measured in the M1 of the Högebo male and can be given a similar interpretation. She clearly did not spend her first years in Falbygden nor in an area with Precambrian geology. Possible regions are first of all parts of Scania and a narrow stretch along the Swedish west coast. For archaeological reasons, the first alternative is more likely. At some point after the age of ca three years, she moved away and was finally deposited in a wetland in Falbygden at the age of 18–19 years. Unfortunately, we cannot follow her movements in more detail since we do not yet have data from the M2 and M3 teeth. In any case, she is an interesting example of a long-distance mover in a time when the neolithisation of southern Scandinavia was rapidly progressing northwards.

Table 2. Strontium and oxygen isotope values from the two individuals (Data from Sjögren *et al.* 2017 and Blank *et al.* 2023).

Individual	Tooth	Lab.no.	$^{87}\text{Sr}/^{86}\text{Sr}$	$\delta^{13}\text{C}_{\text{enam}}$ VPDB (‰)	$\delta^{18}\text{O}_{\text{carb}}$ VPDB (‰)	Sex	Age
Högebo (MP3)	M1	MA-150309	0.71103	–14.22	–4.71	male	17–25
Högebo (MP3)	M2	MA-150310	0.71146	–14.02	–5.97	male	17–25
Högebo (MP3)	M3	MA-150311	0.72237	–14.71	–6.92	male	17–25
Hallonflickan	M1	F6994	0.71160	–13.50	–4.40	female	18–20

DISCUSSION AND CONCLUSION

As noted above, Hallonflickan with her early date can be seen as part of the neolithisation wave that affected Scandinavia in the years after 4000 cal BC, with new and genetically distinct groups moving northwards bringing cereals, domestic animals, and new types of artefacts. They also brought immaterial things in the form of knowledge, customs, belief systems, and

rituals, such as the practice of human sacrifice in wetlands, of which she herself bears one of the earliest witnesses.

We do not know if she travelled alone or as part of a group, but it seems likely that she did not belong to the first generation of migrants into Falbygden, but rather followed already established routes and was guided and

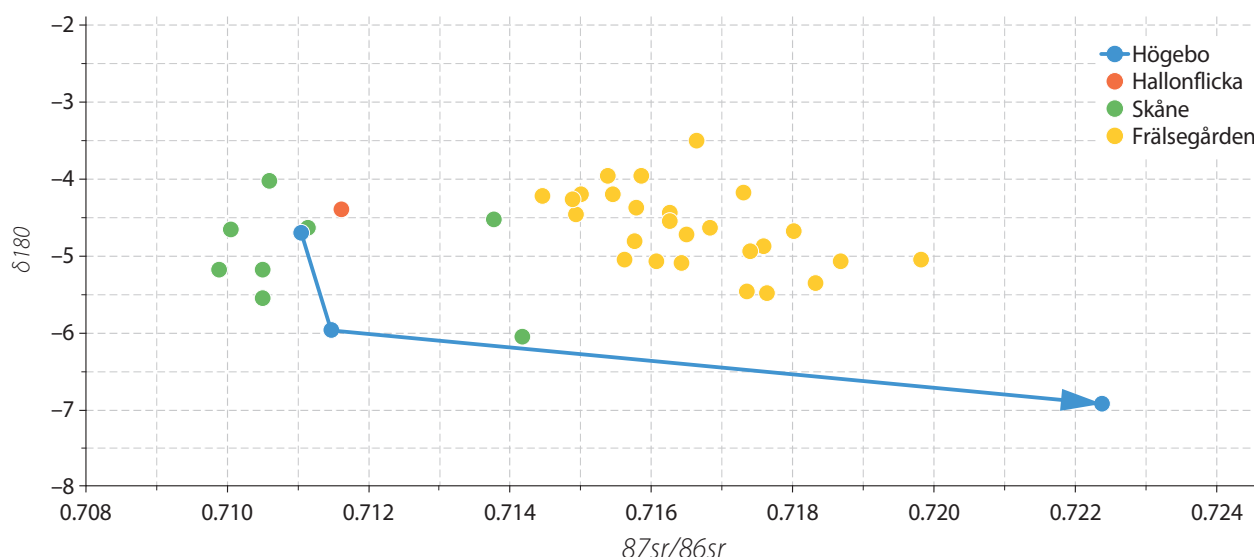


Fig. 5. Isotopic data from the two individuals, compared to Early and Middle Neolithic (EN–MN) individuals from Scania and early Middle Neolithic (MNA) individuals from the Frälsegården passage grave in Falbygden (Data from Sjögren *et al.* 2017 and Blank *et al.* 2023).

assisted by existing connections with kin or other allied groups. At present, her case seems unusual, but the number of analysed Early Neolithic individuals in Sweden is very small, and it is in fact likely that she is indeed a representative of larger groups of people moving north during the first centuries of the Neolithic. If this is the case, she would not in any way have stood out as a “foreigner” but rather have been one of many with a similar background, and her origin cannot be used to explain why she was chosen for the dubious honour of being sacrificed.

In the Högebo case, we have more detailed information. Most likely, he was born in southernmost Sweden, in an environment similar to that of Hallonflickan. After a first relocation in childhood, he seems to have lived his teen years in a more radiogenic and colder environment, but not in the near vicinity of the burial he was found in. We cannot be sure of his whereabouts in this period, but some possibilities may be mentioned. While the Precambrian regions of western Sweden have matching Sr isotope signals, the oxygen isotope values in contemporary humans from passage graves in Falbygden do not match. We should therefore probably look further north. One region that may be suitable is the province of Värmland, north of lake Vänern. This region has similar bedrock to Västergötland and a generally colder climate, and is partly also matching Sr isotope values according to a coarse mapping of soil samples (Hoogewerff *et al.* 2019), but unfortunately no studies of oxygen isotopes in Neolithic humans exist so far. Archaeologically, we find the northernmost border of Funnel Beaker settlement going through this region (Heimann 2005). Most areas of Norway would not fit

the Sr isotope values, if we rely on the soil sample mapping of Julian Hoogewerff *et al.* (2019).

His final resting place in a Late Neolithic gallery grave on Kinnekulle presents another conundrum. The site has isotopic baselines quite different from the values in his M3 tooth, suggesting a move towards the south after the age of *c.* 14 years, whereafter he died at the age of 17–25 years. Where he stayed in this period is unknown, but a likely guess is somewhere in western Sweden. Another, perhaps less likely possibility is that he was transported after death to be buried.

As there is a likely time difference of some 1000 years between his death and the construction of the gallery grave, our interpretation is that his bones (or some of them) were taken from an earlier grave and redeposited in the gallery grave, possibly as a kind of initiation ritual. Similar cases of probable reburial of old bones were reported by Malou Blank *et al.* (2020) for two multi-roomed gallery graves with portholes in Falbygden. These are cases where the majority of ^{14}C dates are Late Neolithic, but single dates deviate by falling in the Middle Neolithic Funnel Beaker (TRB) period, *i.e.* the period of passage graves.

Where he was buried originally is another difficult question. Most likely, his first grave was located in an area with calcareous bedrock, such as Falbygden and Kinnekulle, since his bones would not have survived for 1000 years in the more acidic Precambrian regions. At our present knowledge, no graves from the Funnel Beaker (TRB) period are known from Kinnekulle, but this may just be due to lack of investigations. Falbygden on the other hand is famous for its concentration of Middle Neolithic passage graves with

well-preserved skeletons, and Early Neolithic dolmens are also now being documented (Sjögren *et al.* 2023). We may therefore suspect that bones were taken from a megalithic tomb in Falbygden to be placed in a newly built gallery grave at Högebo, as part of an initiation ceremony and as a way to demonstrate attachment to an ancestral tradition. Ironically, however, the ancestry of the passage grave people was very different

from that of the people building gallery graves, as recent isotopic and genetic research has demonstrated (Blank *et al.* 2021; Allentoft *et al.* 2024). The resurgence of megalith construction and re-use of old monuments in the Scandinavian Late Neolithic may therefore be seen as based on a highly fictional ideology, a myth about attachment and belonging to ancestral ways, their monuments and their landscape.

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Neolithic Long Houses as Symbolic Rudimental Archetypes of the Copper Age Long Barrows

Jan Turek

KEYWORDS: trapezoidal Neolithic longhouses, Copper Age long barrows, ancestral monuments, symbolic archetypes, symbolic rudimentality, Central and Western Europe

Abstract

The idea of a symbolic relation between Neolithic longhouses and long barrows has a long pedigree, the genesis of the phenomenon of long barrows is, however, still a matter of discussions. In this paper I am going to discuss the period of the genesis of the symbolic archetype of first “specialised”, purely funerary long barrow constructions. During the 5th millennium BCE, the long houses built in the trapezoid form spread not only in the Danubian and the Rhine territories but also in the Parisian Basin and present-day Belgium. During this

period, the first long barrows were constructed in the same shape, representing the symbolic link between the houses of the living and the houses of the dead. This form continued even during the 4th millennium, such as the barrows of the Funnel Beaker culture, while the forms of dwellings changed into an oblong ground plan. The symbolic continuity of rudimental archetype artefacts follows a number of symbolic rules, such as the orientation and the internal structure, carrying an archetypal ancestral, far reaching legacy.

Zusammenfassung

Die Idee einer symbolischen Beziehung zwischen neolithischen Langhäusern und Langgräbern reicht weit in die Forschungsgeschichte zurück, die Genese des Phänomens der Langgräber ist jedoch immer noch Gegenstand von Diskussionen. In diesem Beitrag werde ich die Entstehungszeit des symbolischen Archetyps der ersten „spezialisierten“, rein bestattungsbezogenen Langgräber diskutieren. Im 5. Jahrtausend v. Chr. verbreiteten sich die Langhäuser in Trapezform im Donau- und Rheingebiet, aber auch im Pariser Becken und im heutigen Belgien. In dieser Zeit wurden auch die ersten Langgrä-

ber in dieser Form errichtet, die die symbolische Verbindung zwischen den Häusern der Lebenden und den Häusern der Toten darstellten und die sich auch im 4. Jahrtausend fortsetzt — wie die Gräber der Trichterbecherkultur — während sich die Formen der Behausungen zu einem länglichen Grundriss wandeln. Die symbolische Kontinuität der rudimentären und archetypischen Elemente folgt einer Reihe von symbolischen Regeln, wie der Ausrichtung und der inneren Struktur, die ein archetypisches, weitreichendes Vermächtnis der Vergangenen Zeiten darstellen.

INTRODUCTION

This study aims to discuss the question of the emergence of the symbolic archetype of the Neolithic trapezoidal longhouse, which has been preserved in rudimentary form in funerary monuments (long barrows, funerary enclosures, dolmens) for almost two millennia. We will first focus on the chronological definition and development of this type of house. Then

we turn our attention to the origin and development of trapezoidal long barrows and megalithic tombs in Europe. We define this transformation as a highly symbolic expression of a relationship to ancestors and a celebration of mythological time in the form of “petrified social meaning.” The rudimentary persistence of archetypal forms in human culture can be interpreted

as an expression of respect for ancestors, but also of genealogical affinity expressed through the conservative maintenance of specific traditions. Such traditions could be preserved for many generations even in a completely symbolic form that no longer had its original utilitarian function. Finally, we will try to define

the phenomenon of sacred ceremonial rudimentality in human culture. The metaphorical transfer of the archetypal meaning of archaic artefacts to later cultural and technological contexts occurred repeatedly in the development of human culture in various spheres of activity and material forms.

CHRONOLOGY OF THE NEOLITHIC TRAPEZOIDAL STRUCTURES IN EUROPE

The idea of symbolic relation between Neolithic longhouses and long barrows has a long pedigree (Childe 1949). Also in the case of trapezoidal shaped barrows, dolmens and funerary enclosures it is presumed the developed from the archetype of earlier longhouses (Chambon 2020, with further references; Turek 2022). Let's follow the transformation process from houses of living to the houses of the dead that started already in the first half of the 5th millennium BCE.

After 5000 BCE the *Bandkeramik* (LBK) house form (Fig. 1) legacy started fading out. The ground plan shape and internal arrangements of houses changed and became increasingly regionalised.

Despite the apparent regionalisation and new cultural heterogeneity of the post-LBK development, one unifying element can be seen, and that is the architecture of the dwellings. It is the trapezoidal longhouse plan that links Western and Central Europe, *i.e.* the areas of the Villeneuve-Saint Germain – Cerny – Hinkelstein – Grossgartach – Rössen and Stroke Pottery Culture and later also the Lengyel and Brzesc Kujawski Culture (Fig. 2). This building style seems to have spread quite rapidly from the Paris Basin in an easterly direction, and it was only through subsequent development that its regional formal differentiation occurred.

A similar process of geographical diffusion seems to apply to later funerary monuments of trapezoidal form. The earliest evidence is known from the Paris Basin (Chambon 2020, with further references), while trapezoidal long barrows from Kujawy, Silesia and Bohemia fall, according to the most recent dating (Król 2021; Jarosz *et al.* 2020; Turek and Krištuf 2023; Krištuf *et al.* 2023), as late as the early 4th millennium BCE. While for the Western Europe Philippe Chambon (2020, 50) mentioned the middle of the 5th millennium BCE long mound of Lannec er gadouer in Erdeven (Morbihan, Brittany) and perhaps even earlier examples of early/middle Neolithic Passy types of monuments (Fig. 3).

Christian Jeunesse (2021, 23) considers the hypothesis of convergent development of trapezoidal mounds as two different phenomena approximately simultaneously in western and central Europe. In both cases, their formal development would follow the architecture of houses of the post-LBK (*Bandkeramik*)

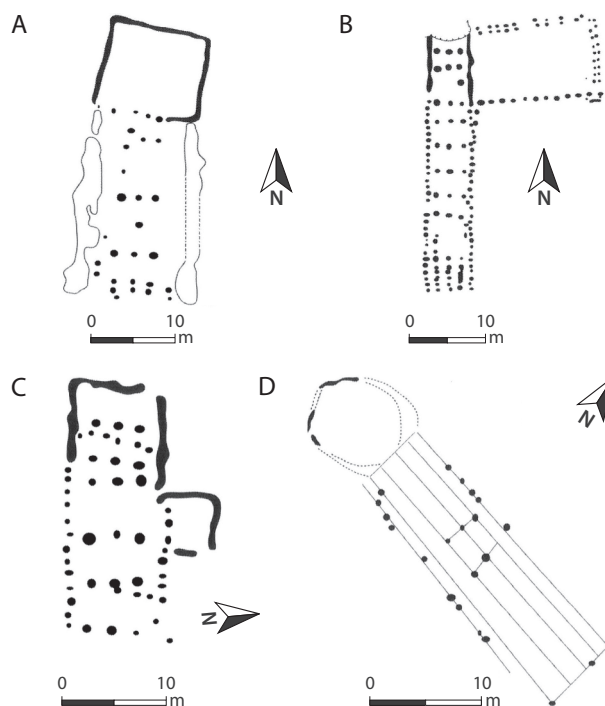


Fig. 1. Linear Pottery Culture longhouses with enclosure annexes that perhaps represent the earliest ancestral shrines. A Mintraching; B Bylany; C Elsloo; D Immenhausen (after Lüning 2009 and Bickle 2020, 70 fig. 5.6).

tradition. It should be noted, however, that the current reassessment of the chronological position of the Kuyavian barrows in Poland does not support such an interpretation. In fact, the Kuyavian monuments are almost 500 years later than their Brzesc Kujawski longhouse form-models from Sarnowo and other sites and they are contemporary with similar long barrows in Bohemia (Krištuf *et al.* 2023). Dariusz Król literally mentions that:

“Considering only the fully reliable data, it seems that the oldest monumental necropolises have appeared in the Polish Lowlands not earlier than c. 3900/3800 BCE, and possibly even later ...”. (Król 2021, 121, 209)

Evžen Neustupný was emphasizing the origin of megalithic idea in the Danubian Neolithic tradition

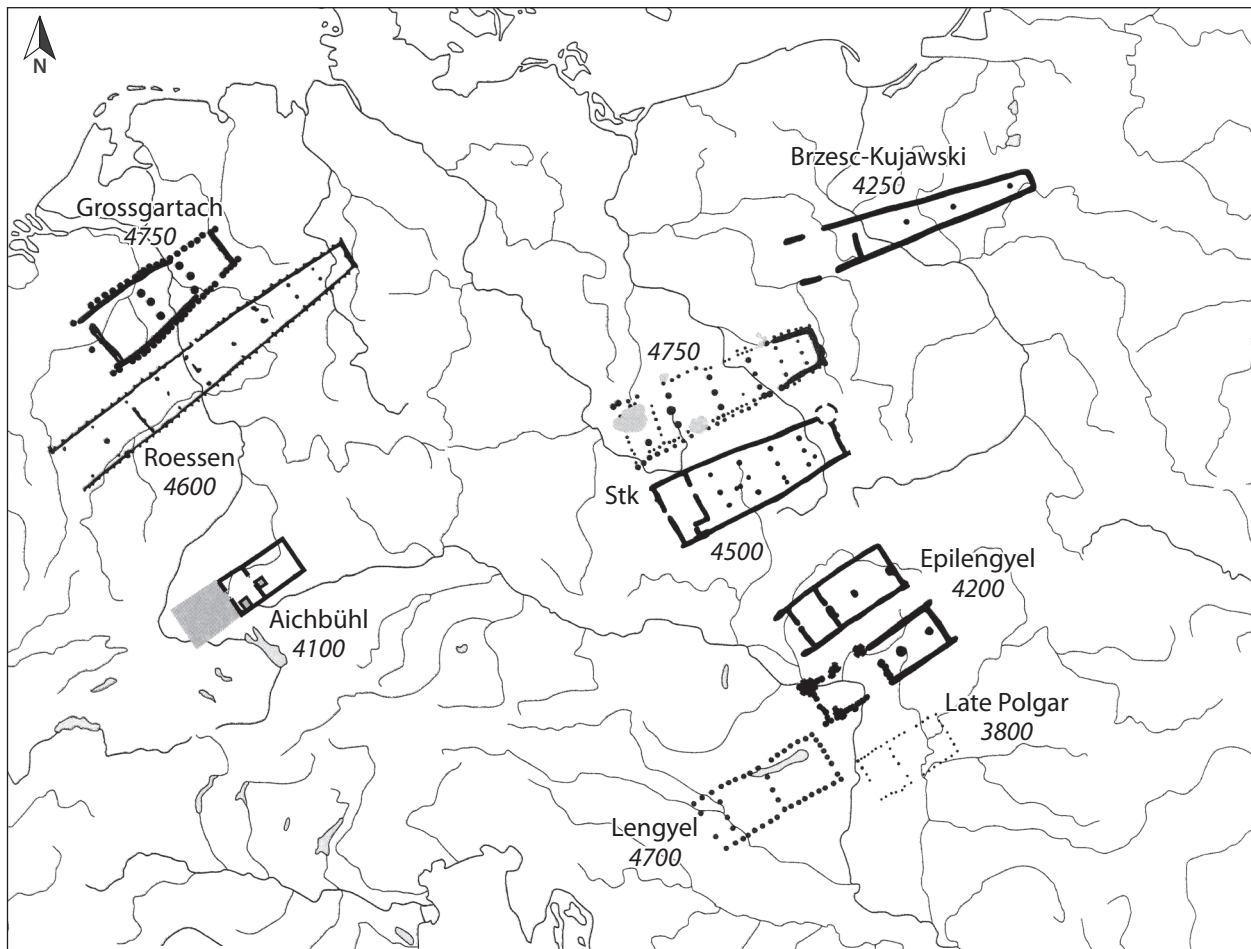


Fig. 2. Map of distribution of post-LBK trapezoidal longhouses in the Danubian Neolithic. The house orientations do not refer to the reality of the archaeological record (after Jeunesse 2016, 19 fig. 17).

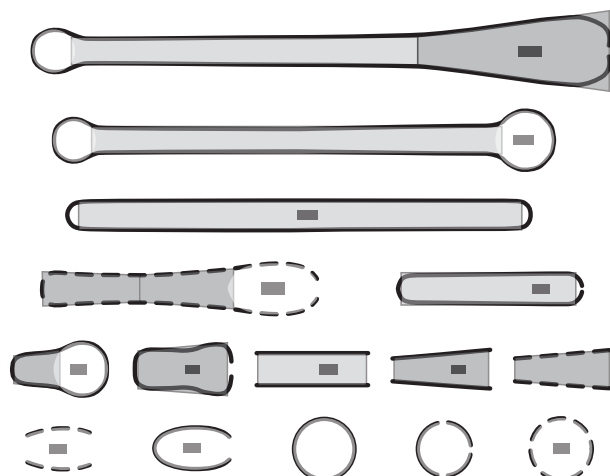


Fig. 3. The scheme of the Passy type funerary monuments ground plans (after Chambon 2020, 52 fig. 4.1).

(cf. also Müller *et al.* 2019). The earthen long barrows were part of the monumentality phenomenon (megalithic package) which is a result of the LBK legacy with no Mesolithic roots. The occurrence of ceremonial constructions (causewayed enclosures and long barrows) belongs to the “package” of new phenomena that in transalpine territory first appeared at the end of the 5th millennium BCE (Neustupný 2001, 204–205). The earliest examples of long barrows are, however, not of the eastern origin and they developed in the north-western France already during the first half of the 5th millennium BCE (cf. Chambon 2020). The tradition then spread northwards, into the British Isles, Low Countries and southern Scandinavia, as well as to Central Europe. Each area developed its own variations of the long barrow tradition, often exhibiting their own architectural innovations and further development (Křišťuf *et al.* 2023).

CREATION OF AN ARCHETYPE

The origins of burial mounds and the creation of funerary monuments are still not sufficiently explained. The assumption of the creation of long earthen barrows by the direct reutilization of abandoned houses that have been transformed into houses of the dead is increasingly assumed (Midgley 2005; Turek 2005; Turek 2010; Bickle 2020; Chambon 2020; Pyzel 2020). It is therefore possible to assume that the archetype of the house of the dead had already emerged in the earlier Neolithic, as a kind of transitional form from abandoned houses to funerary monuments (for types of LBK houses see Fig. 1). Abandoned houses became the first mounds by covering part or all of the ground plan with a mound consisting of the house debris and material exploited from so called construction/loam pits. This would also explain why these pits along the long walls of the houses are excavated in both loess and clay, which are plastic materials suitable for the construction of house walls, but also in sand and gravel, which may have been used to top the mound but not as material for the construction of the house (Neustupný 1995). Magdalena Midgley thus correctly assumed the transformation of the house of the living into a burial mound, but still allowed for the existence of elongated loam pits at the time of house construction and use (Midgley 2005). I suggest that it was these mounds over the extinct houses that allowed for the precise spatial continuity of the houses and the later purely funerary constructions of the long mounds. Such continuity has been repeatedly observed in *Bandkeramik* settlements in Poland and Bohemia. These include the site at Bożejowice (Czerniak 1998; Midgley 2005) or Roztoky (Kuna 1991; Turek 2010), but similar situations have also been recorded in the Paris Basin in the case of Rubané houses (Fig. 4) overlapped by later funerary constructions at Balloy (Mordant 1997; Chambon 2020, 53 fig. 4.2) or at Gurgy (Delor 1996; Bickle 2013; Turek 2016).

But when did the actual separation of residential and funerary functions and the emergence of purely funerary monuments occur? Philippe Chambon (Chambon and Thomas; 2010; Chambon 2020, 48–50 fig. 4.1) argues that this was already the case before the middle of the 5th millennium BCE in the Paris Basin in the form of Passy-type monuments. Already some of these earliest long barrows have trapezoidal shapes (see Fig. 3) and are probably based on house plans of the Villeneuve-Saint Germain (VSG) Culture (Bickle 2013, 162–163).

It is therefore possible that sometime before the mid-5th millennium BCE the phenomenon of trapezoidal long barrows was established in the Paris Basin, which spread over a wide area of the northern part of the European continent to the eastern part of Central Europe over the next thousand years. In the environment of the

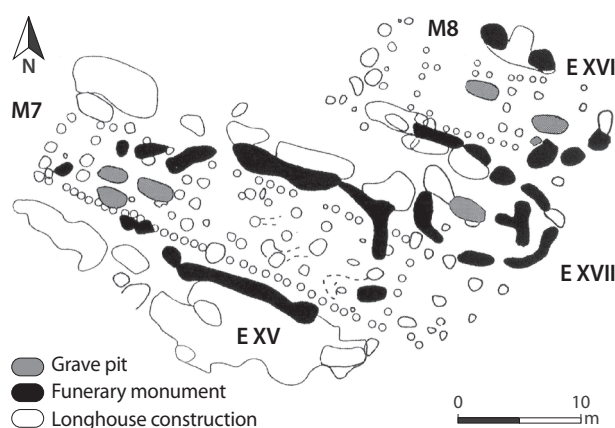


Fig. 4. Two funerary monuments at Balloy, overlapping earlier Rubané longhouses (after Chambon 2020, 53 fig. 4.2).

Stroke Pottery Culture and the Lengyel Culture around 4800 BCE and later about 4300–4200 BCE in the Brzesc Kujawski Culture, there were longhouses of a distinctly trapezoidal construction (see Fig. 2), which, however, did not yet have a counterpart in funerary forms of a similar plan. This process of diversification and the emergence of the first trapezoidal barrows in Kujawy sites such as Sarnowo or Wietrzychowice (Chmielewski 1952) did not occur until around 3900–3800 BCE (Król 2021), 600–700 years later than in the Paris Basin area and almost a thousand years after the first trapezoidal houses in Western Europe. It should be borne in mind that by the time of the construction of long trapezoidal mounds in Greater Poland (Król 2021), Silesia and Bohemia (Křišťuf *et al.* 2023; Turek and Křišťuf 2023; Zápotocký 2023), which is 3700–3500 BCE trapezoidal houses were no longer being built. Typical houses in the Funnel Beaker Culture period were rectangular post-and-beam structures between 20 and 30 m long and 6–7 m wide. Structures with circumferential rows of columns supporting walls were oriented in an east-west direction with a row of roof ridge postholes along the main axis of the houses (Turek 2014, 220–224). It is clear, therefore, that the trapezoidal shapes of the long barrows were based not on the contemporary Funnel Beaker houses, but derived from ground plans of houses a thousand years earlier.

The interpretation of this phenomenon seems to lie in the worship of an ancestor cult, with which the trapezoidal shape of the house of the dead would have been associated. It is possible that the trapezoidal form of the houses of the Villeneuve-Saint Germain Culture in the Paris Basin gave rise to the archetype of the sacred ancestral house, which was symbolically transferred to the ground plans of the houses of the dead, *i.e.* earthen long barrows. Longhouses of this plan were a char-

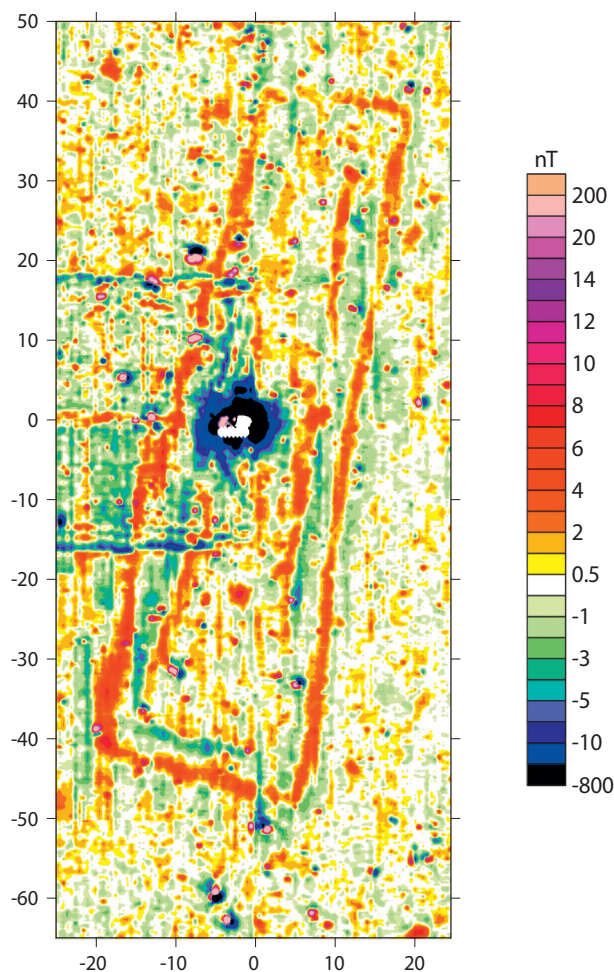


Fig. 5. Visualisation of geomagnetic survey (by Roman Křivánek) of the Funnel Beaker long barrow from Dušníky (Litoměřice district, Bohemia). Dimensions of the monument 14–24 m wide, 86 m long, East (wider end) – West orientated (after Turek and Křišťuf 2023, 638 fig. 2).

acteristic architectural manifestation in northwestern and central Europe in the first half of the 5th millennium BCE. Evidence of them has been recorded in Baden-Württemberg and Westphalia (Hinkelstein and Grossgartach Culture and later Rössen Culture), but also further east in Bavaria, Central Germany, Bohemia and Moravia in the setting of the Stroke Pottery Culture and later in the Lengyel Culture (Končelová 2013; Jeunesse 2016). In general, this phenomenon predominantly covers the territory of the preceding Linear Pottery Culture, or what is referred to as the territory with the Danube Neolithic tradition (*ibid.*, 18).

In building the long barrows, a number of symbolic rules and actions had to be fulfilled. These include, first of all, the orientation in the east-west direction, the structuring of the internal arrangement of the monument, including the location of the burial chamber. A characteristic feature of some mounds is the al-

location of a kind of “antechamber” on the eastern side of the structure, which was tentatively interpreted as an ancestral shrine (Křišťuf *et al.* 2023). In addition to the Czech example from Račíněves (Turek and Křišťuf 2023), examples of so-called “Megaxylons chambers” in the entrance to the barrow were excavated for example, in the sites of Słonowice and Gaj in Poland (Papiernik *et al.* 2018). On the example of the Funnel Beaker long barrow (Fig. 5) from Dušníky (Litoměřice district) in North Bohemia, a specific choice of building material for the mound’s embankment has even been demonstrated, which was exclusively dark chernozem meticulously gathered from the vicinity of the monument (Křišťuf *et al.* 2023).

The evidence of spiritual continuity of some long barrows was recently discovered in Bohemia consists in repeated sacrificial activities carried out over a period of at least several decades. The funerary function thus remains only one, initiatory phase of the use of these monuments (Turek and Křišťuf 2023). Subsequent activities may have been related to some form of ancestral cult, but the primary burial was not followed by other funerary events. All the evidence of later burials and re-use of the monument was at least one thousand years later than the time of the barrow construction. The primary funerary function of the monuments then appears to have been transformed into more of an ancestral shrine than a purely burial monument. The functioning of some long barrows as communal monuments appears to have been completed by the excavation of trapezoidal ditches (respecting exactly the barrow shape) that enclosed not only the area of the shrine but also the period of its use. It is as if the digging of the moat closed an epoch in the life of the community, which continued to relate to a new monument subsequently built on a different site (*ibid.*; Křišťuf *et al.* 2023).

Such ancestral shrines may have much earlier pedigree. Richard Bradley presumes an existence of an ancestral shrine in the north-west end of some *Bandkeramik* (LBK) long houses (Bradley 2001, 53). Some LBK houses are even supplemented with a sort of rectangular extension on their northern or north-western end (Fig. 1 A–B, after Lüning 2009, 162; Bickle 2020, 69–70 fig. 5.6). Alternatively, a round ditch enclosure was attached to the north-western end of a house in Immenhausen (Fig. 1 D). Jens Lüning (2009, 154–156) presumes these were some kind of social gathering places and calls them ‘cult complexes’ or even ‘house shrines of ancestral kin’. Such assumption is in line with the interpretation of house 912 from Bylany suggested by Bohumil Soudský (1966; 1969), describing this extraordinary large house with an extension in the north-western end as a ‘gathering house’. I believe it should be emphasized that in cases of the Mintraching

and Bylany houses (Fig. 1 A–B) it is well possible that these annexes were attached to the original house construction after its transformation into a house of the dead (barrow), representing an original form of later ancestral shrines located as antechambers of some Funnel Beaker long barrows.

From this point of view the trapezoidal shape of some long barrows may be referring to worship of an ancestral cult, emphasizing the traditional archetype of the trapezoidal ground plan related to mythical ancestral time and celebrating the ancient tradition of houses of predecessors (Turek 2022).

SYMBOLISM OF RUDIMENTAL ARTEFACTS



Fig. 6. The pointed trapezoidal dolmen structure from Petit Chasseur, Sion Switzerland (after Gallay 2011).

The symbolism of the trapezoidal ground plans of the Neolithic longhouses transferred to the funerary monuments represents more than two thousand years of collective memory. It should be borne in mind that the extremely pointed ground plans of the stone dolmens (Fig. 6) from Petit-Chasseur in Sion (Gallay 2011) and Saint-Martin-de-Corléans in Valle d'Aosta (Mezzena 1998) were built after the mid-3rd millennium BCE, yet they follow the symbolic 'sacred' shape of houses used in other parts of Europe as early as the first half of the 5th millennium BCE. This phenomenon can be described as a rudimentary symbolism that has been deliberately maintained in human culture for a long time as a reminder of the mythological, sacred and ancestral reality of generations of ancient ancestors.

The rudimentary persistence of archetypal artefacts, materials or technologies can be interpreted as a manifestation of respect for ancestors, but also of gene-

alogical affinity expressed by the fundamentalist maintenance of traditions. Such traditions may have been preserved for many generations even in a completely symbolic form that no longer had its original utilitarian function. The phenomenon of sacred ceremonial rudimentality in human culture and the metaphorical transfer of the archetypal meaning of archaic artefacts to later cultural and technological contexts occurred repeatedly (Turek 2024) in the development of human culture in various spheres of activity and material forms.

In some aspects of human culture, the relationship to traditional activities and technologies may have evolved into a ritualized repetition of activities and practices, as in the case of silicite mining at the Krumlovský les site (Znojmo district). Here, Martin Oliva (2019) has documented the continuity of hornblende mining from the Neolithic to the late Iron Age (La-Tène period), when



Fig. 7. Golden beaker (c. 1750 BCE, height: 118 mm) rudimentally resembling earlier Bell Beaker forms, from Eschenz, Kanton Thurgau, Switzerland (Photo: Jan Turek).

neither the material nor the technology of the chipped industry had any utilitarian significance anymore, and was maintained as a far-reaching ancestral tradition by which people symbolically revered not only the traditional technology, but also, presumably, the divine gift of the ancient raw material.

FAR REACHING TRADITION OF PREHISTORIC BARROWS

The symbolism of longhouses in funerary monument forms ends during the 3rd millennium BCE, when circular barrows became widespread in Europe with the Yamnaya, Corded Ware, Bell Beaker and Únětice Cultures, but they perhaps also follow the idea of the house of the dead, and some of their burial chambers were constructed as log interiors with an apex roof (Turek 2010).

However, even these round barrows are aligned along an elongated axis in some burial sites, which may perhaps relate to the custom of orienting long barrows in the landscape. An example can be found at the Bell Beaker Culture burial site at Estling (near Olching, district Fürstentfeldbruck, Upper Bavaria), where a remarkable accumulation of 21 burials was recorded stretching continuously from north to south in a line nearly 130 m long on a terrace above a now extinct watercourse (Winghart 1999).

Symbolically rudimentary artefacts from prehistory and antiquity can be listed in a number of examples. They are mostly associated with cultic and ceremonial activities, which usually have formal and material connotations to archetypal rituals and symbolic activities. An example is the transformation of an ancient weapon in the form of a mace into a sovereign's scepter as part of the medieval crown jewels. Another example may be the case of flint knives used in Egypt throughout the New Kingdom up to the Roman period (when copper or iron butcher tools were commonly used for the profane slaughter and meat processing) for ritual butchering can be considered an archetypal rudiment (Ikram 1995, 69–70). Ancient technology or material was maintained here as part of the sacrificial celebration of the gods and respect for ancestors.

Another example of symbolic rudimentality can be seen in Early Bronze Age (c. 1750 BCE) golden ceremonial beakers (Fig. 7). Several hundred years after the disappearance of the last continental Bell Beakers some very similar vessels re-occurred, but this time they were made of gold. There are seven currently known golden beakers/cups from different parts of Western Europe. The Bell Beaker style and decoration perhaps survived in form of precious metal ceremonial vessels a long time after the real Beakers went “out of fashion”. It is possible that some traces of the original Beaker ideology sustained in some kind of transformed way and the golden beakers were used as symbolic representation of the relation to their religion and ancestors (Turek 2013, 19–20).

Another example of such ceremonial structure in the landscape of Low Countries was recorded by Quentin Bourgeois (2013) in the Veluwe region. In the landscape transect of eight by 8 km Bourgeois recorded all together 110 Late Neolithic and Bronze Age barrows, 46 of which are creating the single line alignment pattern. These barrows stretching between cadastral of Epe and Niersen are dated to the Late Neolithic A (Single Grave Culture 2850–2500 BCE) and B (Bell Beaker and Veluwe Culture 2500–2000 BCE) and later Bronze Age periods follow a well-defined southwest-northeast alignment crossing landscape in a straight single line of nearly 6 km.

Round burial mounds/kurgans were built throughout the Bronze Age and early Iron Age. The early medieval cemeteries in many regions of Europe are also represented by burial mounds. As the Christian rite became established in Europe, the custom of mound-

ing over ancestral graves gradually disappeared from burial customs at the beginning of the 2nd millennium BCE. However the notion of barrows never disappeared from people's minds. The tradition of building mounds was preserved in the case of memorials to famous battles, following the example of the mound of the Athenian warriors at Marathon: this tradition was

followed by the imperial powers at the sites of important early 19th century battles of the Napoleonic Wars, such as Austerlitz or Leipzig. In this rudimental revival of burial mounds the prehistoric funerary memorials of an individuals and families has become an inspiration for creation of monuments commemorating the collective identity of a wider political alliance.

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(Re)building Societies – Labour Expenditure Associated with Monumental Grave Landscapes in Northern European Prehistory

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KEYWORDS: Northern European prehistory, monumental grave architecture, labour expenditure, social inequality

Abstract

Enduring markers of monumental grave architecture are one of the defining characteristics of Neolithic and Bronze Age societies in Northern Europe. Occurring in different forms, such as dolmens, passage graves, and earthen burial mounds, these monuments represent not only important places of social interaction but also a form of human labour investment into defined areas of individual and communal burial practices. These monuments encompass a wide array of representations, from collective and presumably communal, non-hierarchical efforts to the visible manifestations of social inequality. In this contribution, we will follow the tem-

poral development of the labour expenditures over the course of the Neolithic, the Bronze Age, and the Iron Age in the defined study region of Northern Europe. This comparative analysis includes the internal differentiation of labour that was invested in contemporaneous monuments, leading to the formation of hotspots of altered surroundings for past communities. The work and efforts put into these places of socio-political and economic signalling represent the creation, maintenance, and long-term development of a specific landscape that holds public interest until today.

Zusammenfassung

Monumentale Grabbauten sind ein charakteristisches Merkmal der neolithischen und bronzezeitlichen Gesellschaften Nordeuropas. Diese Denkmäler, die in verschiedenen Formen wie Dolmen, Ganggräbern und Hügelgräbern auftreten, sind nicht nur wichtige Orte sozialer Interaktion, sondern auch eine Form der Investition menschlicher Arbeitskraft in bestimmte Bereiche individueller und gemeinschaftlicher Bestattungspraktiken. Diese Denkmäler umfassen ein breites Spektrum von Darstellungen, von kollektiven und vermutlich gemeinschaftlichen, nicht-hierarchischen Bemühungen bis hin zu sichtbaren Manifestationen sozialer Ungleichheit.

Der vorliegende Beitrag verfolgt die zeitliche Entwicklung dieser Bestattungspraktiken im Verlauf des Neolithikums, der Bronzezeit und der Eisenzeit im definierten Untersuchungsgebiet Nordeuropas. Diese vergleichende Analyse schließt die interne Differenzierung der Arbeitskraft ein, die in zeitgleiche Monumente investiert wurde und zur Bildung von Hotspots einer veränderten Umwelt für vergangene Gemeinschaften führte. Die Arbeitskraft und die Anstrengungen, die in diese Orte mit sozio-politischer und wirtschaftlicher Signalwirkung investiert wurden, stehen für die Schaffung, Erhaltung und langfristige Entwicklung einer spezifischen Landschaft, die bis heute von öffentlichem Interesse ist.

INTRODUCTION

Ostentatious displays of labour expenditure in the realm of burial rites are a distinct and recurring marker of communities in the past and present (e.g. Trompette 2012; Rivollat *et al.* 2022; Chambon and Thomas 2023). Yet the perception of what qualifies as ‘ostentatious’ varies greatly and must always be seen in its social and political context. In modern contexts, we know, for example, the monumental burials of political leaders, activists, or dictators (e.g. The former Mausoleum of Francisco Franco in the Valle de los Caídos; cf. Palmer 2019). These burials stand in stark contrast to any kind of contemporaneous common burial rites and play an important role in public remembrance and political propaganda. These kinds of burials may truly be called unique, ostentatious, or outstanding. Taking a great leap into the past, even the design of the great burial mounds or ‘princely graves’ of the early Iron Age in Europe somehow pales in comparison. Yet these burials exhibit such a wide range of precious grave goods and complicated building structures (cf. Müller-Scheeßel 2018) that they may still be called impressive and should be regarded as monumental burials of persons who, for unknown reasons and unclear socio-political standing, were perceived as deserving of such a display.

Going further back in time, the burial mounds of the Nordic Bronze Age do not reach the sheer size nor the over-abundance of presumably valuable grave goods of their Iron Age counterparts. On closer inspection and in comparison to other burials of the same period, these mounds still exhibit equally impressive and labour-intensive structures (such as the use of ‘Grassoden’; cf. Holst and Rasmussen 2013) and often rare grave goods that are now perceived as valuable (cf. Kienlin 2008). With a final step backwards in time, we observe both grave mounds and megalithic grave monuments in the Neolithic periods, especially in Single Grave and Funnel Beaker contexts in Central and Northern Europe (cf. Hübner 2005; Midgley 2008). These graves do not necessarily contain grave goods that are in any way special or uncommon within other forms of burials (cf. Bakker 2010) and, with regard to the megalithic graves of the Funnel Beaker Culture, collective burials are a common characteristic (cf. Midgley 2008). At the same time, the monuments themselves are a product of moderate to extensive labour invested by demographically small communities. Some of the monuments are unique in their design and layout while, taken together, many of the megalithic graves form parts of monumental burial grounds that have been centres of communities building, using, and expanding them over centuries (e.g. Andersson *et al.* 2016). We may now ask whether these burials may still be called ‘monumental’ when

compared to their Iron Age counterparts. To address this question, we will present comparative labour expenditure calculations of Neolithic to Iron Age burials in our study area.

Research Area and Time

Focusing on parts of what today is called the Northern German Plain and the Cimbrian Peninsula, we use both extensively analysed samples of megalithic tombs as well as interpolations for wider geographic contexts. The detailed samples especially include labour expenditure calculations from the areas of Eastern Holstein and Stormarn in the south-eastern part of Schleswig-Holstein (cf. Wunderlich 2019), the western part of Mecklenburg-Vorpommern and the island of Rügen, as well as the area of the Elbe-Weser triangle in Lower Saxony (cf. Wunderlich *et al.* 2024). Due to the higher complexity of the calculations of megalithic graves in comparison to later earthen burial grave mounds, the use of these sample areas and the subsequent interpolation of these values were necessary to achieve supra-regional results.

Chronologically, we focus on the periods of the Neolithic, Bronze Age, and Iron Age in the aforementioned regions. During these periods, the primary archaeological entities considered due to their burial rites are:

1. **Funnel Beaker communities (4100–2800 BCE):** Megalithic graves include the chamberless long barrows (probably the earliest type), several types of dolmens (such as small, extended, or polygonal dolmens; appearing already in the late Early Neolithic; cf. Sjögren 2011; Hage 2016) as well as passage graves (appear in the early Middle Neolithic). While the smallest of these types (especially small dolmens) were likely used for single or a very low number of burials (Behrens and Darvill 2021), the later larger types (especially the passage graves) were used for collective burials.
2. **Single Grave communities (2800–2350 BCE):** In the context of the Late Neolithic, the burial rite changed fundamentally. The custom of collective burials was given up in favour of single burials in burial mounds. The burials can be differentiated with regard to their position in the burial mound; there are lower, medium, and upper burials, each consisting of one individual (Malmer 1962; Ebbesen 2006). The architecture of the burial mounds themselves in Single Grave contexts is usually rather simple. Although the

burial might be accompanied by a stone concentration, the monuments consist of rather simple earth mounds (Hübner 2005).

3. **Late Neolithic communities (2350–1700 BCE):** The Late Neolithic in our geographical area is represented by the so-called “Dagger groups” on the Cimbrian Peninsula and the Danish isles and Bell Beaker groups south of the Elbe river. This period is characterised by the appearance of bifacial flint daggers and sickles as well as increased occurrences of copper items. The burial rite in most areas remained individualised, with the dead buried in single stone cists or, more seldom, burial mounds (Apel 2001; Johannsen 2023).
4. **Older Bronze Age communities (Period I–III 2200–1100 BCE):** Within the context of the Older Bronze Age, the burial mound phenomenon reappears. They exhibit single central burials, not seldom equipped with overly rich grave goods (cf. Kristiansen 2010; Schaefer-Di Maida 2023). This burial rite may have been influenced by the Central European Únětice groups (c. 2200–1600 BCE), where the burial mounds were erected for a smaller group of very likely socio-political and economically influential persons (Meller 2019). Later, within the so-called “Tumulus groups” of the Central European Bronze Age (c. 1600–1300 BCE), the burial mound building becomes more frequent and was less dominated by a few huge burial mounds (e.g. Marzian *et al.* 2024).
5. **Younger Bronze Age and Early Iron Age societies (Period IV–VI 1100–500 BCE and Jastorf 500–0 BCE):** With the Younger Bronze Age and the beginning of the Iron Age, the number of burial mounds decreases sharply again, and the burial rite of cremation becomes prevalent in the context of the pan-European phenomenon of the Urnfield Culture (c. 1200–800 BCE; Schaefer-Di Maida and Kneisel 2023). From 800–400 BCE, with the onset of the Hallstatt Iron Age, the tradition of burial mounds is revived again, with some of the most spectacular exemplars known from Central European prehistory (e.g. Müller-Scheeßel 2013). In Northern Europe, burial mounds during the Iron Age (500–0 BCE) are small, seldom and often contain urn burials (cf. Brandt 2014).

Ways to Invest Labour – A Functionalist View

In line with the quantifying approach used here, a functional view on labour calculations is central to the analyses aimed for. This approach focuses purely on the time (e.g. Abrams 1984) or, more rarely, energy in

kcal (e.g. Lacquement 2009) that has to be invested in certain activities required for an overall goal. This goal could be the production of a certain tool (such as flint adze heads; Müller 2024) or the construction of large burial structures (such as megalithic graves or burial mounds, e.g. Müller 1990; Craig *et al.* 1998). This approach, which may be called architectural energetics (cf. McCurdy and Abrams 2019) or labour expenditure calculations as in this contribution, is closely linked to the concept of a chaîne opératoire (cf. Tafelmaier *et al.* 2020). However, in this context, labour expenditure calculations do not necessarily reach the fine identification and separation of single working steps, as well as the social, political, and economic contexts surrounding and influencing these. Simplified, it can be stated that analyses about labour expenditure calculations aim to reconstruct the time required for specific working steps usually based on ethnographic or experimental analogies and therefore reach an understanding of necessary energy or time investments related to certain activities. Typical fields of these analyses are agricultural activities (e.g. Kerig 2011), house or building construction (e.g. Erasmus 1965; Webster 1991; DeLaine 1992; Kim 2013), or the already mentioned burial monument constructions (e.g. Renfrew 1973; Bernardini 2004; Abrams and LeRouge 2008). Indeed, the field of architecture is one in which these kinds of calculations are done more usually than in the other fields mentioned here. To be comparable, interoperable, and quantifiable, it is necessary to agree on certain standard parameters and values (cf. Abrams and McCurdy 2019). If, for example, the clearance of a certain area for agricultural activities is necessary, at least the felling of trees must be calculated. For this kind of calculation, usually a standard diameter of the trunks will be used in addition to a standard felling time derived from experimental values, possibly rounded up by a standard distance.

Obviously, this approach does not allow for individual aspects such as the age, health conditions, experience, or strength of the individuals actually carrying out a certain activity. As these are only rarely traceable in the archaeological record and would contradict the inter-comparability of the approach, these factors are usually ignored in favour of a standard or mean value. Physical factors such as soil types or climate conditions are also usually not taken into account (Abrams and McCurdy 2019). The approach described here tends to focus on an efficient and time-saving way to execute tasks or activities — a condition which may derive rather heavily from lived realities. Not always do humans follow an efficient approach towards labour that has to be done — other aspects such as rituals, the importance of collectives, or others may also play a significant role.

In its interpretative framework, the functionalist view follows Bruce Trigger's (1990) notion about monumental architecture and sees its defining feature as

"its scale and elaboration exceed the requirements of any practical functions that a building is intended to perform." (Trigger 1990, 121)

He argues that conspicuous energy consumption is a symbol of power, making the construction of monuments and energy-intensive investments for *"non-utilitarian purposes"* the representation of power structures and therefore political and economic inequality.

Ways to Invest Labour – An Anthropological View

While a more functional or rational approach towards calculations of labour expenditures is undoubtedly useful and necessary to formulate a basis of comparative analytical frameworks, we want to introduce a second dimension worth considering here. There are many different ways to invest in or perform labour endeavours — from effective to ostentatious — and we should take into account this variability in archaeological case studies even if there might be no easy way to include these possibilities in, for example, quantitative analyses.

One way to provide a wider perspective on this aspect is to include ethnoarchaeological perspectives. Among the very few regions in the world where megalith building still is — or was practised until recent times — is Northeast India and the island of Sumba in Indonesia (cf. Adams 2007; Marak 2018; Wunderlich 2019). Both regions were included in the project "Equality and Inequality" of the DFG-priority program 1400 "Early Monumentality and Social Differentiation". In this context, ethnoarchaeological fieldwork, including a comprehensive documentation of megalithic monuments as well as the recording of details about the building practices via interviewing, was conducted. The results of these documentations may broaden our understanding of how building endeavours may work both in contexts of socio-political stratification and non-stratified communities (cf. Wunderlich 2019; Wunderlich *et al.* 2021).

The most important results with regard to the research question at hand are the following:

1. The use of quarries or source locations may follow patterns of convenience, efficiency, and quality of the source material — yet it might as well be influenced by prestige gained by using specific locally available material or by a challenge provided by long and complex ways of transportation.

2. On the island of Sumba, a number of quarries are available for the stone slabs cut from the limestone sources scattered over the island (cf. Fig. 1). Due to the abundance of the material and the small size of the island, there are usually suitable sources close to the villages available. There is, however, especially one source in the southern part of the island which is said to be of the highest quality. The use of stones from this quarry usually involved a certain distance of water transport in addition to the overland distance and therefore is much more complicated and expensive than the use of other sources. As more prestige is gained by more complex building endeavours, the use of this quarry is very popular albeit rarely achievable. In general, greater distances were pronounced as being desirable due to them providing further proof of the capabilities of the monument's builder.
3. The overall process of constructing a megalithic monument may follow a fast schedule — or might be subject to extensive delays or interruption by other related activities.
4. Apart from the aforementioned choice of quarries and their influence on the transportation time, further delays have been described both in Sumba as being desirable under specific circumstances. In Sumba, it was said that the workers involved in the dragging process were to be given food by the monument builder on every day of their involvement. One way to further prove one's own capabilities was therefore to prolong the dragging process and therefore be subjected to further feasting activities for the people involved in this activity.
5. The group of people involved in the building process may tend to be much larger than what is strictly necessary. Especially the labour-intensive steps that are a potential arena of display of socio-political structures tend to involve large crowds of people; both as onlookers and for the work itself (*e.g.* during the stone dragging).
6. This factor was described as relevant both in Sumba as well as in southern Nagaland. In Nagaland, it was explicitly said that the size of the stones did not have a strong significance and that the effort put into the transportation of the stones would not be less if the stone was small. Instead, it was the previous feasting series itself and the accomplishment of the highest stage of the same that was significant and justified the immense expenditure that was put into the transportation and erection of the stones. These activities involved big crowds of people and also served as a display and performance of social roles and prestige within the village communities.



Fig. 1. View of an active quarrying area in Sumba, Indonesia. The stone slabs carved out of the limestone deposit are used as capstones for the megalithic tombs (Photo: Maria Wunderlich).

METHODOLOGY: LABOUR EXPENDITURE CALCULATIONS

For the labour expenditure calculations, we follow foremost a functionalist approach towards work that describes and measures the different working steps in the construction of megalithic graves and grave mounds. The absolute numbers deriving from this approach are given in person-hours (*ph*), *i.e.* the labour invested by one person in hours. The calculation of the time needed for the execution of single working steps (such as the dragging of the stones for the chamber or the kerbs, the digging of the pits for the orthostats, *etc.*) is based upon a formula which is in turn based on experimental or ethnographic comparative values (for a more detailed description of this approach with regard to megalithic graves, see Wunderlich *et al.* 2024). The values for each grave monument are not realistic in the sense that it indeed took this precise time to build the monument, but they are comparable with each other and give at least an idea of the necessary time to be invested in different monument types over time. Indeed, these numbers are to be seen as a kind of minimal value or, in other words, an efficient estimation of time needed for all working steps combined. The anthropological view on how to construct monumental tombs,

which, as written above, showed how important inefficiency could have been during the construction process, is especially important in the interpretation of the results but cannot be implemented in the calculations themselves.

The majority of the main working steps in the construction of a megalithic tomb or a burial mound are easily summarised. It must be noted here that this scheme is a simplification of the building process and does not entail highly individualised characteristics or components of single monuments. Furthermore, it is especially well known with regard to megalithic graves that the construction of, for example, a burial mound may have taken place over a longer period involving, for example, extensions of the burial mound (*e.g.* Brozio 2016). Different construction phases of the monuments are not included in this approach due to the usually imprecise dating of the monuments which does not allow a consideration of working phases. Instead, the calculated *ph* must be seen as the calculation of the last form of the monument. Furthermore, certain working steps could also have been earlier in connection with other activities; an example is the clearing of

the land which could also have been done for purposes like house building or agriculture. Nevertheless, and since for the vast majority of the graves these factors remain unknown (but in contrast: Steffens 2009; Brozio 2016; Müller 2019; Mischka 2022), this working step is calculated anyway.

Two main uncertainties arise regarding the labour expenditure calculations:

1. the distance assumed for the transport of earth or sand, but especially the boulders and other stones needed for construction. As our case studies are all located in areas with an abundance of naturally available erratics and other stone material, we assume a standard distance of 1 km (cf. Bekkema 2013).
2. the use of draft animals and carts for the transport of earth or smaller stones. Although depictions on stones and ceramic vessels (e.g. Kappel 1990; Milisauskas and Kruk 1991; Bakker *et al.* 1999), the tracks of wheels in Flintbek (Mischka 2011; Mischka 2022), and finds of wheels (e.g. Velušček 2009; Klimscha 2017) clearly prove the existence of carts that have been pulled by cattle from c. 3500 BCE. Yet under consideration of the rather dense forestation especially during the Early and Middle Neolithic (EN and MN), the terrain from which the erratics originated was not necessarily accessible (Kirleis 2022). With the intensification of agricultural activities and the subsequent clearing of landscapes over the course of the Neolithic and Bronze Age (Feeser *et al.* 2019; Johannsen *et al.* 2024), this would become less of a problem yet still up to dispute. One possibility that is clearly shown by the ethnographic record is the intentional and artificial protraction of the working process, which may

include the use of rather inefficient methods for transportation (e.g. Adams 2019). But certainly, the use of carts should not be excluded categorically, especially in light of the close symbolic connection between cattle, carts, and megalithic monuments (cf. Pigière and Smyth 2023).

We assume that in the course of constructing a megalithic or non-megalithic burial monument, basic labour tasks need to be done. This includes, for example, clearing a place for the monument, gathering and transporting smaller stones, as well as timber production for tools and scaffolding. Those kinds of tasks, in their quantification of labour, have high uncertainty. This is due to the fact that the numbers of small stones for stone pavements or else are not quantifiable from literature. Further, it is not sure if the clearance of the place is connected to the planned erection of the burial monument. Gathering and transporting smaller boulders and stones may also have happened “aside” during clearing and tilling cereal fields or other economic plots. To include all possible labour tasks for each grave, the number of usable graves would decrease enormously. In addition, we would only add a lot of uncertainty which, in general, is good; however, in the scope of this study, we are interested in testing the general feasibility of labour investment calculation for comparative purposes. Therefore, we decided to only quantify and calculate the labour of major tasks, *i.e.* erection and transport of megaliths as well as digging and transporting earth, and sum up those tasks. Additionally, we would argue that smaller scale tasks involved, *i.e.* stone pavements or dry-stone walling (*Zwickelmauerwerk*), are scaling to the size of the monument. The latter we can approximate by modelling the volume of the burial mounds as a hemisphere.

MATERIALS

The data basis of 3005 burial monuments included in this study was gathered and analysed in two recent studies: Maria Wunderlich *et al.* (2024) explored the economic potential of Neolithic communities of the Northern German Plain based on the labour expenditure of megalithic grave monuments and polished stone axes, while Johannes Marzian *et al.* (2024) investigated the inequality of an upper societal segment in Central Europe based on burial mound volumes. Combining both data sets and restricting them geographically to the Northern German Plain, the Cimbrian Peninsula, and the Danish isles offers the possibility to diachronically investigate the labour invested into the erection of grave monuments in the region.

Many of the burial mounds and some of the megalithic tombs are only roughly dated by typochronological means. In this case, the actual erection date of a monument may span over several hundred years. To overcome this challenge, we assign these mounds to a chronological stage based on the probability distribution of well-dated burial mounds in the respective time span. Additionally, we exclude burial mounds whose initial dating exceeds a time span of 1400 years from the analyses to increase the reliability of the dating approach. With this approach, we can create a 200-year resolution time-series (Marzian *et al.* 2024).

Figure 2 shows the spatio-temporal coverage of burial mounds and megalithic tombs in our research area.

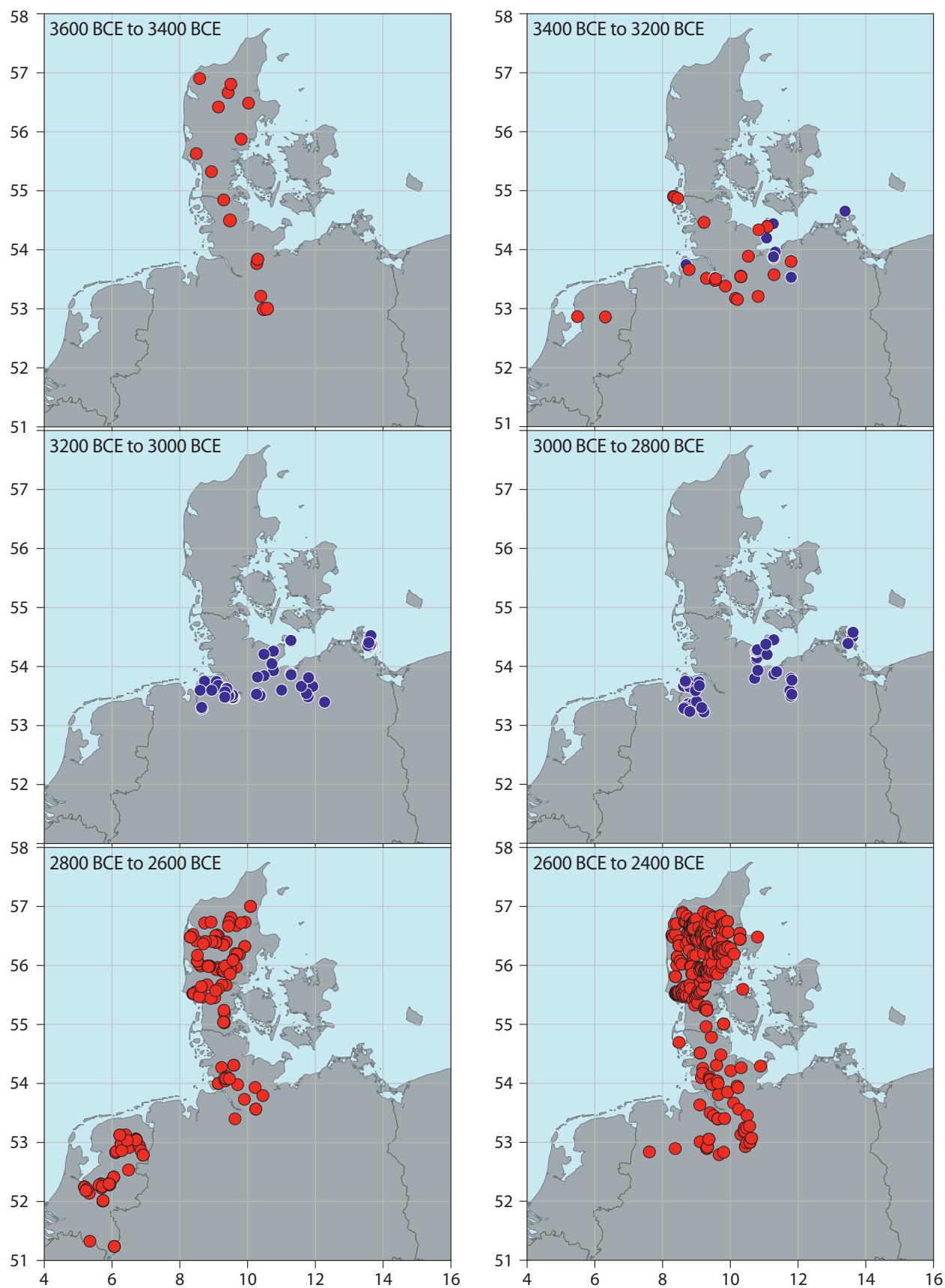


Fig. 2a. Spatial distribution of burial monuments sites in each of the 200-year steps. Red dots show the location of earthen burial mounds. Blue dots show the location of megalithic burial monuments (Graphic: Julian Laabs; maps: Karin Winter).

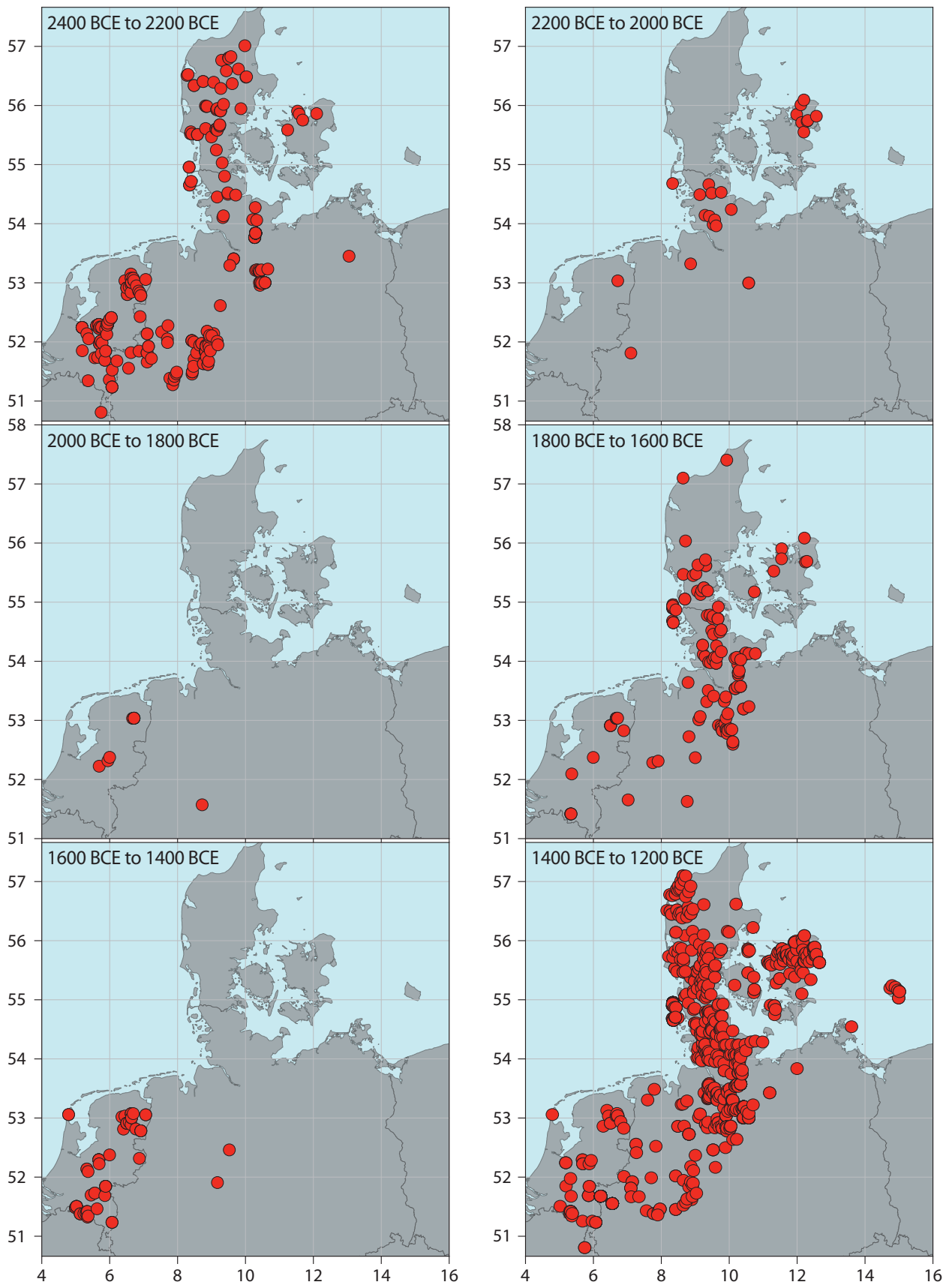


Fig. 2b. Spatial distribution of burial monuments sites in each of the 200-year steps. Red dots show the location of earthen burial mounds. Blue dots show the location of megalithic burial monuments (Graphic: Julian Laabs; maps: Karin Winter).

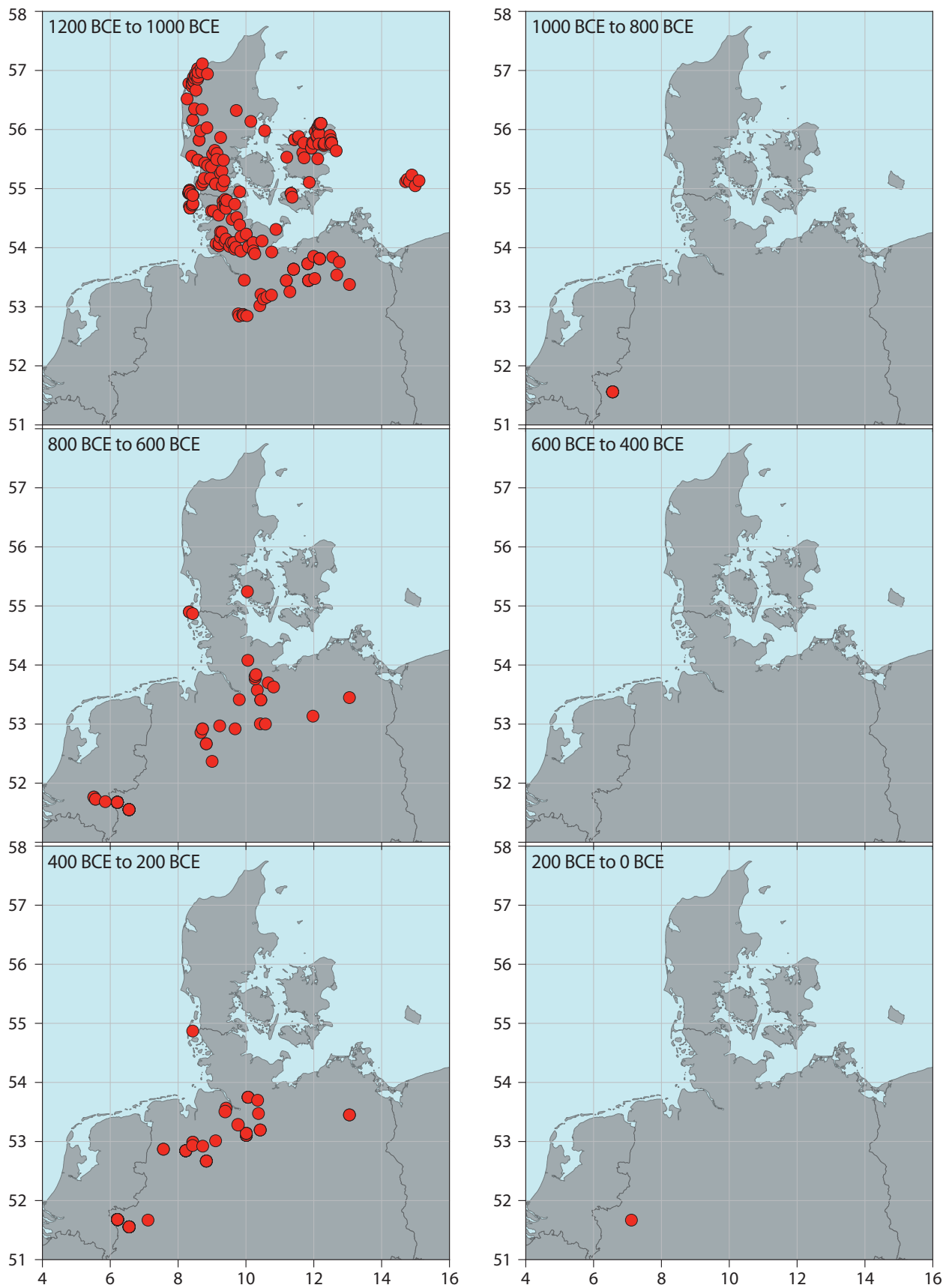


Fig. 2c. Spatial distribution of burial monuments sites in each of the 200-year steps. Red dots show the location of earthen burial mounds. Blue dots show the location of megalithic burial monuments (Graphic: Julian Laabs; maps: Karin Winter).

The maps show that our data set covers most of today's Denmark, the Netherlands, Schleswig-Holstein, Niedersachsen, and Mecklenburg-Vorpommern. Our chronological coverage of burial monuments is best during the time frame of Single Grave Groups from c. 2800–2350 BCE and during the Period I–III of the Nordic Bronze Age c. 1800–1100 BCE. In other phases, there is just less building activity (e.g. 2350–1800 BCE, 1100–0 BCE). The reduced number of megalithic monuments from 3400–2800 BCE compared to the abun-

dance of known and excavated megaliths in Northern Europe results from the fact that we draw our data from already published work on labour expenditure. Although the number of burial monuments could very likely be increased in most of our time slices, the data set at hand will provide us with a representative sample on labour expenditure.

For details of the workflow of the data preparation, labour expenditure calculations, and visualisation, consult the supplementary material.

RESULTS

Figure 3 shows the time series of violin plots visualising the labour expenditure in ph of burial mounds dating within the specific 200-year steps. The binning of the burial monuments in 200-year steps shows an interesting trend in labour expenditure over time. In the Early to Middle Neolithic (3600–2800 BCE), burial monuments saw high labour investments, including the EN non-megalithic long barrows. The trend until MN is increasing, which is due to the introduction of megalithic tombs. The upward trend from 3500 to 2800 BCE is driven by the increasing elaboration of megalithic architecture. While in the earliest time slices (3600–3400 BCE), earthen long barrows and simple dolmens are dominant, from 3400 BCE dolmens and other megalithic structures increased in size and architectural complexity, ending with passage graves around 3000 BCE (Müller 2011; Wunderlich 2019). The EN to MN trend of investing more labour into monuments stopped with the appearance of single grave earthen burial mounds, which in their initial phase are connected to a single deceased individual. This is a major change of cultural behaviour in the mortuary rituals being focused on individual persons and the building of non-collective burial monuments. Over the course of the so-called “Single Grave Culture”, we see a rather steady median size of burial mounds while the earliest (2800–2600 BCE) and later (2400–2200 BCE) phases see few outliers with high labour expenditure. In the early dagger time period (c. 2200–2000 BCE), respective Bell Beaker period, the few burial mounds erected show similarities to the phase of the Single Grave groups; however, the average

mound size increased. This looks different from 2000–1800 BCE, where very few burial mounds were erected, and average size decreases slightly. However, the time from 2200–1800 BCE on the Cimbrian Peninsula is connected to the reuse of MN megalithic graves or the erection of stone cists without earthen mounds (Johannsen 2023). With the onset of the developed Central European Bronze Age c. 1800–1600 BCE, Period I in our research area, we see a surge in single grave burial mounds again, in size very similar to earlier periods. A small decrease in size and number can be witnessed from 1600–1400 BCE. But with period III (1400–1100 BCE) of the Bronze Age, a rise in number and size of burial mounds is clearly visible, lasting until c. 1100 BCE, which explains the high median sizes between 1200–1000 BCE. With Period IV (1100–920 BCE) and with the phase of introducing the burial rite of cremation, erecting new burial mounds seems to have lost its importance. From Period IV until the end of the Iron Age (c. 1100–0 BCE), few new burial mounds were erected, and they shrunk in size compared to Period III mounds. Exceptions to this trend include the enormous burial mounds at Seddin (Germany), Oss (the Netherlands) and Lusehøj (Denmark), as well as some likely lost or poorly dated burial mounds. Burial mounds of this size are often connected to the idea of 'kings' ruling over a large territory (Hansen and Schopper 2018). The burial mounds dated between 400–200 BCE are connected to cemeteries of the Iron Age Jastorf groups in Niedersachsen, the Iron Age *tuegrave* of the Cimbrian Peninsula are not included in the data set.

DISCUSSION AND SYNTHESIS

The mapping and the results show three phases of the (re-)introduction of monumental burial architecture: 1) (Non-) megalithic tombs c. 3600–2800 BCE, 2) earthen burial mounds from c. 2800–2350 BCE, and 3) the latter burial type again from c. 1800–1100 BCE. While

the labour expenditure invested into megalithic monuments usually increased over time, Single Grave and Bronze Age developments begin with initially larger mounds, after which a decrease in labour expenditure followed. After this decrease, expenditure increases

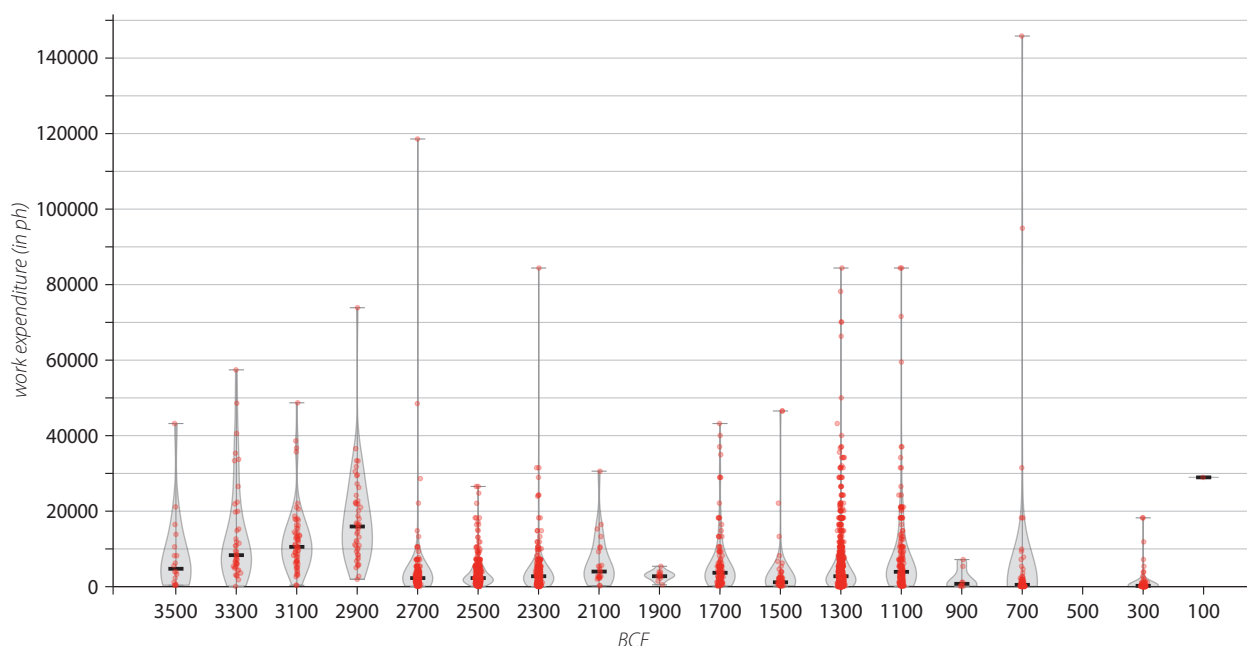


Fig. 3. Labour investment distribution into burial monuments for each of the 200-year steps. Bold black bars indicate the median (Graphic: Julian Laabs).

again until the tradition of mound building is abandoned.

Due to the use of erratic boulders for chamber and kerb constructions, Funnel Beaker Culture grave monuments require higher labour investments on average. The comparatively high labour input into these at least partly collective grave monuments that can be found in monumental burial grounds (e.g. Andersson *et al.* 2022) can be well explained by socio-political mechanisms of competition and communality. Especially the working step of the transport and erection of the boulders offers and may even require a platform to integrate high numbers of participants. We can therefore see this kind of monumental construction as a well-suited arena for social display and conspicuous consumption. Here we want to raise awareness of the aforementioned ethnographic examples. Stone dragging itself is a labour-intensive step which naturally involves larger groups of people than the transport of earth might. It is therefore also an ideal way to display economic and socio-political capabilities of monument builders — whether they are individuals or communities.

Towards the Late Neolithic, we see the rise of comparatively modest grave mounds in Single Grave contexts, at least according to the labour that is invested in their construction. Therefore, the existing monumental landscape is altered and expanded. While the number of the monuments is rising, their complexity and size are decreasing. We interpret this pattern as a materialisation of smaller reference groups and a growing importance of the display of individuality. The po-

tential for the display of conspicuous consumption via construction activities is lower due to the abandonment of the most complex working steps. Yet the mounds do preserve a high potential as an arena for socio-political display and competition. As grave mounds intended for single or individual burials, we see a growing need or desire of these communities to emphasise material and/or relational wealth and maybe power of individuals and within smaller reference groups (cf. Marzian *et al.* 2024). We would argue that this reflects a reduction in cooperative network structures and an increased focus on inter-group competition. Perhaps this mechanism overpowered the need to display communality and social cohesion, which seem to have been more in the foreground during the Early Neolithic and especially the Middle Neolithic.

After a break in labour investments into monumental landscapes during the Late Neolithic and dagger period contexts, we see that the existing monumental landscapes are taken up and expanded by Bronze Age communities. The aforementioned trend towards displays of individuality seems to be taken even further during the Bronze Age. This trend of individualisation is also reflected in the consumption of symbolic and socially prestigious items like axes, daggers, and swords (Brozio *et al.* 2024). Despite the references towards the monumental landscapes that were created during the Neolithic periods, we see a differentiation of these landscapes during the Bronze Age. The grave mounds are increasingly oriented towards road systems, which are likely connected to trade and exchange networks

(cf. Nakoinz 2012; Holst *et al.* 2013). The aspect of economic display therefore seems to have more importance than during the previous periods. In contrast to the Older Bronze Age, the Younger Bronze Age communities of our study area seem to focus more on equalised grave good consumption while the display of individuals was preserved. During this time, the number and average size of burial mounds decreased with few notable exceptions and bronze consumption in hoards increased (Brozio *et al.* 2024). This is also the time when the burial rite of cremation was introduced and the tradition of linear cooking pit alignments emerged. The latter are interpreted as locales of reconciliation and perhaps were structures in which collective labour was invested (Schaefer-Di Maida 2022).

The Iron Age burial rites are again very different from the previous periods; here a break in the former traditions can clearly be seen. Distinct burial grounds are now providing a spatially separated place for the burial of members of given communities. In these, burial mounds only play a minor role; these mounds are very small and few in number (*e.g.* Ettel 2014).

Summarising the processes described above, we can trace the creation of highly performative and collective

landscapes of monumental burials (Funnel Beaker Culture) that are changed and expanded into more fragmented landscapes of individual burial mounds during the Late Neolithic and Bronze Age. The display and materialisation of individual importance and perhaps power, as well as trade and exchange networks, seem to have substituted the need to display collectivity while the aspect of competition and social signalling was surely preserved, albeit via smaller reference groups. There are clear constants within these landscapes, and we can see processes of the expansion and alteration of existing spaces of memory. Despite the high impact that is discernible in the labour input into megalithic graves, later communities seem to have also preferred other ways to structure their environments. While the practice of depositions is already present during the Early and Middle Neolithic, their importance rises quite clearly by the Bronze Age. Not only the rising number of hoards during this time but also the construction of cooking pit alignments is an important element to structure existing landscapes during this time. Later on, during the Iron Age, Celtic fields, are certainly important parts of the materialisation of socio-political structures in the landscape (Arnold 2011; Løvschal 2014).

SUPPLEMENTARY MATERIAL

The supplementary material for this research is available online at <https://doi.org/10.5281/zenodo.11357874>.

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CHAPTER 7

Johannes' Favourites



Figure chapter 7: Haldensleben-Küsterberg, Saxony-Anhalt, Germany. Reconstruction of the Funnel Beaker period passage tomb 92 from the 35th century BCE (Drawing: Susanne Beyer; graphic: Petra Horstmann).

Too Many Indians and Not Enough Chiefs? ¹

Michael Geschwinde

KEYWORDS: *enclosures, social structures, Michelsberg Culture, Baalberge Culture*

Zusammenfassung

Ausgehend von einer Überlegung Johannes Müllers zur Identifikation sozial herausgehobener Bestattungen der Baalberger Kultur wird im Rahmen einer Literaturrecherche die aktuelle Diskussion zur Frage der sozialen Strukturen des Jung- bzw. Mittelneolithikums

zwischen Rhein und Elbe zusammengestellt. Im Mittelpunkt steht die in der Forschung kontrovers diskutierte Frage, welche Rückschlüsse die Anlage zahlreicher Erdwerke zwischen 4500 und 3500 v. Chr. hierzu erlauben.

Abstract

The paper gives an overview of the actual discussions concerning the interpretation of the social structures of the late/middle neolithic societies in central Germany. Starting from hints given by Johannes Müller for the

interpretation of a special type of burial from the Baalberge Culture as elite-graves, the role of the frequent enclosures as an indicator of social organisation is shown.

MONUMENTALE ERDWERKE UND IHRE ZEIT

Die Errichtung monumentaler Erdwerke mit einer Grabengesamtlänge von mehr als 1500 m oder einer Innenfläche von über 8 ha (Raetzel-Fabian 1999, 90–95) erfolgte im mitteleuropäischen Jung- bzw. Mittelneolithikum vor dem Hintergrund verschiedener Kulturgruppen, die durch Gemeinsamkeiten in ihrer materiellen Kultur, zum Beispiel Formen der von ihnen hergestellten Keramik oder in der Nutzung importierter Steingeräte wie der Jadeitbeile bzw. der Verwendung frühen Kupfers, verbunden sind (Klassen 2014, 206–218).

Während die frühesten Formen von Michelsberg ganz im Westen in absoluten Daten kurz nach 4500 v. Chr. auftreten (Jeunesse 2010b, 46), setzt in Mitteldeutschland die in ihrem in ihrem Verhältnis zu Michelsberg immer noch umstrittene Schiepziger

Gruppe um 4300 v. Chr. ein, bevor sich um 3800 v. Chr. die Baalberger Kultur herausbildet. Um 3500 erfolgt in etwa parallel zum Ende von Michelsberg der Übergang von Baalberge zu Salzmünde (Schwarz 2021c, 68), das selbst bis ca. 3100 v. Chr. läuft. Die Tradition der Errichtung und Nutzung monumentaler Erdwerke begann im Westen im Kontext des frühesten Michelsberg sowie seiner Vorgängergruppen, erreicht während der 2. Hälfte des 5. Jt. v. Chr. den Rhein, aber auch schon den Rand des Thüringer Beckens sowie das Harzvorland und lässt sich bis zum Ende von Salzmünde verfolgen, bevor sie in Bernburg oder in Kulturerscheinungen wie Altheim und Münchshöfen in Bayern von wesentlich kleineren Grabenanlagen abgelöst wird, die zur Befestigung von Siedlungen dienten.

¹ “To many Chiefs and not enough Indians” betitelte Noel D. Broadbent 1983 programmatisch einen einflussreichen Aufsatz.

Der Kulturraum, in dem es zur Errichtung monumental erdwerke kam, ist also durchaus vielfältig. Mittlerweile scheint klar, dass Baalberge und Salz- münde ausweislich der analysierten aDNA in der Tra- dition einer danubisch-mitteldeutschen Population stehen, während Michelsberg eine westeuropäische Komponente mit einem postmesolithischen Anteil enthält (Brandt 2017, 180–185). Aufgrund ihrer Monu- mentalität und des mit ihrer Errichtung verbundenen hohen Arbeitsaufwandes und trotz ihrer immer noch

stark umstrittenen Funktion wird den Erdwerken häu- fig ein hoher Stellenwert bei der Analyse der dahinter liegenden sozialen Systeme und Strukturen zugerech- net. Es lassen sich zwei grundsätzliche Perspektiven unterscheiden: Erdwerke aus dem Blick derer, die um- fassend die sozialen Strukturen dieser Epoche (Gro- nenborn 2016, 61–63) analysieren, und der Blick auf die diesen Anlagen zugrundeliegenden sozialen Struk- turen aus Sicht der Bearbeiter von Erdwerken.

DIE ANALYSE SOZIALER STRUKTUREN UND DIE ERDWERKE

Mit dem Mangel an eindeutig definierbaren regulären Bestattungen (Lüning 1967, 126–134; Jeunesse 2010a; Lüning 2017) und einer in vielen Regionen immer noch weitgehend unerforschten Besiedlungsstruktur (Jeu- nesse 2010b, 49) ist Michelsberg besonders sperrig für die Entwicklung von Modellen sozialer Strukturen. In seiner nach wie vor grundlegenden Studie zur Mi- chelsberger Kultur hat sich Jens Lüning nur in einem Halbsatz im Zusammenhang mit der Funktion der Erdwerke damit auseinandergesetzt, in dem er konstatierte:

„Solange wir jedoch fast nichts über Wirtschaftsweise und die Sozialverfassung der Michelsberger Kultur wis- sen...“ (Lüning 1967, 118)

Lüning sprach sich für eine Deutung der Erdwerke als Befestigungen von Siedlungen in deren Innenräumen aus (ebd., 119) und erwog, dies vor einer Folie einer ge- meinsamen äußeren Bedrohung zu deuten, die am Mit- telrhein begann (ebd.). Im Weiteren schränkt er aller- dings ein und bemerkt:

„Allgemein gilt zu fragen, ob dieser unetstetige Siedlungs- ablauf auf die Funktion der Erdwerke, die als Befesti- gung gegen eine ernsthafte, äußere Bedrohung gedeutet wurden zurückgeht, oder ob sich darin als grundsätz- licher Tatbestand in erster Linie eine weniger sesshafte Wirtschafts- und Lebensweise spiegelt.“ (ebd., 124)

30 Jahre später untersuchte Johannes Müller (2001) umfassend die Sozialstrukturen des Jung- und Spät- neolithikums im Mittel- und Saalegebiet, verstanden als sich entwickelnde Prozesse im Zeitraum zwischen

Gatersleben und Kugelamphorenkultur und basierend auf einer elaborierten Chronologie unter Einbeziehung zahlreicher ¹⁴C-Messungen. Dabei ging es ihm vor al- lem darum, soziale Strukturen nicht mehr ausschließ- lich als chronologische Querschnitte zu erfassen, sondern deren zeitliche Dimension und die sich dar- aus ergebenden Variablen einzubeziehen. Dafür entfal- tet er ein breites Instrumentarium an ethnologischen, soziologischen und archäologischen Methoden (Müller 2001, 21–50). Für die Bewertung von Baalberge ist die Beobachtung wichtig, dass deren Erdwerke in einer Rei- hung² entlang der mittleren und unteren Saale oft mit vergleichsweise beigabenreichen Gräbern verbunden zu sein scheinen (ebd., 284), die Kupferblechobjekte oder Pfeilspitzen enthalten (Abb. 1).³ Auch die Verbreitung keramikreicher Flachgräber und der kreuzschneidigen Axthacken ist dabei einzubeziehen (ebd., 287):

„Allerdings lässt sich eine Gruppe reich ausgestatteter Männer- oder Kindergräber beschreiben, die bei einem Anteil von weniger als 10 % immerhin über 40 % der ext- ramuralen Grabbeigaben besitzen. Diese sieben Gräber liegen bisher alle in der näheren Umgebung von Erdwer- ken. Sie zeigen keine Korrelation zur Grabbauhierarchie. Chronologisch auffällig ist ihre Nähe zu den Erdwerken, die ab ca. 3800 BC cal datieren.“ (ebd., 319)

Dieses Ergebnis ist Johannes Müller so wichtig, dass es in der kurzen Zusammenfassung seiner Untersuchung erneut angeführt wird:

„Hier entstehen ab 3800 BC cal als soziale Fokuse große Erdwerke in Verbindung mit auffallend reich ausgestat- teten Flachgräbern. Möglicherweise erkennen wir eine

2 Eine aktuelle Karte der Erdwerke findet sich bei Ralf Schwarz (2021d, 346 Abb. 25). Obwohl der Bestand an monumentalen Erdwerken deutlich über den von Johan- nes Müller 2001 erfassten hinausgeht, hat sich an der Auf- reihung entlang der Saale wenig geändert.

3 Vgl. dazu Detlef Gronenborn (2006, 138–139), er geht in diesem Artikel auch mehrfach auf die Rolle von Erdwer- ken als Indikatoren für die soziale Gliederung der hinter ihnen stehenden Gesellschaften ein. Dabei bezieht er sich jedoch vorwiegend auf die Linienbandkeramik.

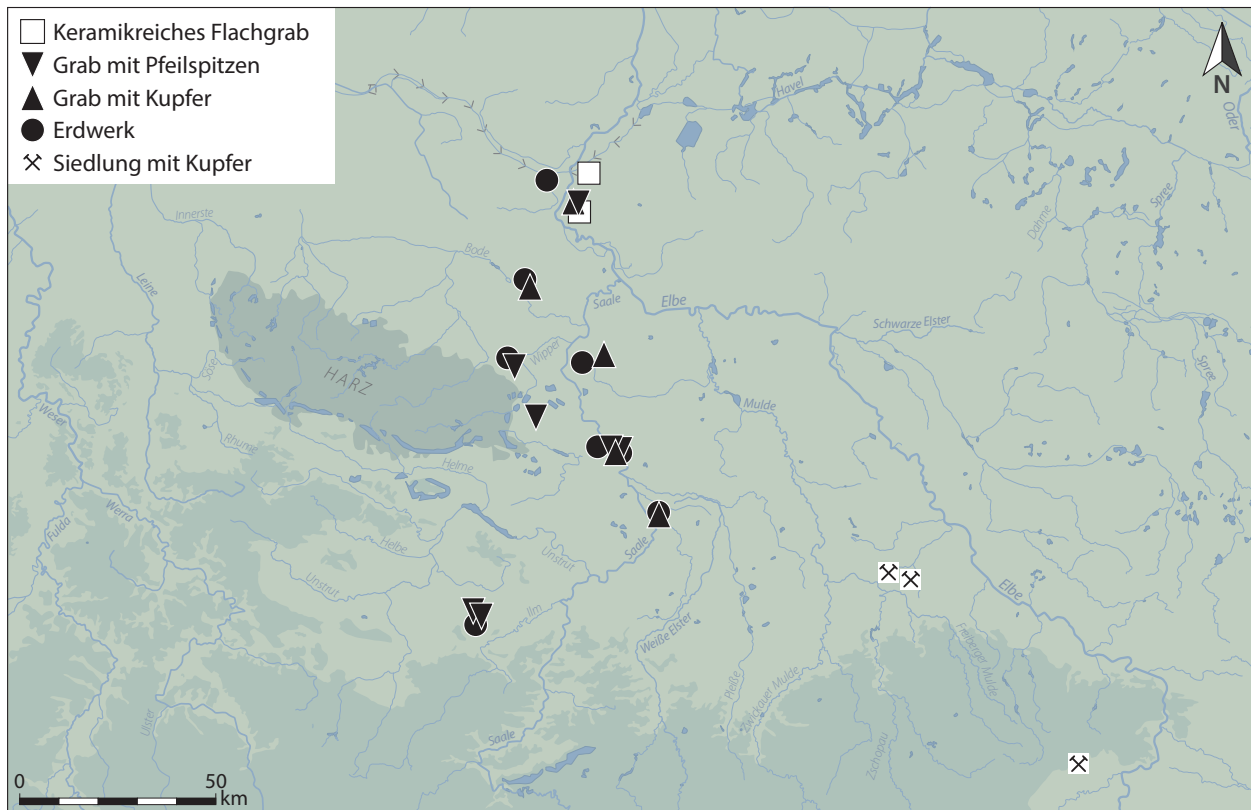


Abb. 1. Die Verbreitung sicherer und möglicher Erdwerke (Stand 2001) im Mittelbe Saale Gebiet und der keramikreichen Flachgräber, der Gräber mit Pfeilspitzen und der Kupferartefakte aus Siedlungen und Gräbern (nach Müller 2001, 289 Abb. 149).

neue Elite, die ihren Status über z.B. Pfeilbewehrung und Kupferschmuck sichtbar präsentiert und sich von der zwischenzeitlich praktizierten Beigabenlosigkeit in Bezug auf nicht-keramische Beigaben abgrenzt. Damit schreitet die Differenzierung der Gesellschaft erheblich voran, was sich u. a. in einer Vielzahl unterschiedlicher Bestattungsmöglichkeiten, u. a. auch der aufkommen- den Kollektivbestattung äußert.“ (ebd., 439)

2010 konkretisierte Johannes Müller bezogen auf Michelsberg und Baalberge das Bild einer aus kleinen Weilern und Einzelhöfen bestehenden Siedlungsland- schaft, innerhalb derer die Erdwerke eine soziale und institutionelle Rolle als Traditionsorte übernehmen

„Nicht mehr die Siedlung an sich, sondern eher Graben- werke oder Grabgruppen und Grabmonumente (wo vor- handen) garantieren als kooperative Kristallisations- punkte einer agrarischen und viehhalterischen Produ- ktion eine generationenübergreifende Stabilität.“ (ebd., 255)

Damit wird eine segmentäre Gesellschaft skizziert, die bestimmt wird von kooperativem Handeln z.B. im Rahmen von Viehhaltung, Heiratspraxis oder

Rohstoffversorgung (ebd., 255). In der gleichen Pub- likation formulierte weiter ausholend Christian Jeun- nesse:

„Die Vorstellungen zur Gesellschaft der Michelsberger Kultur waren lange Zeit von der neo-marxistischen und evolutionistischen Klischeevorstellung eines egalitären und pazifistischen Früh- und Mittelneolithikums und eines kriegerischen und ungleichen Jung- bis Endneoli- thikums geprägt. Inzwischen hat die Ethnologie gezeigt, dass die Bezeichnung egalitär jedoch nur auf einfachs- te Jäger- und Sammlergesellschaften anzuwenden ist. Was die Michelsberger Kultur angeht, stützen sich die Anhänger der traditionellen Sichtweise insbesondere auf das Vorhandensein der großen Erdwerke mit unterbro- chenem Graben, in denen sie Befestigungsanlagen sehen. Deren Bau — so die Argumentation — sei nur denkbar, wenn er von einem Häuptling, der die Macht hat und bei Bedarf auch mit Gewalt eine große Anzahl an „Arbei- tern“ mobilisieren kann, geplant und verordnet wurde... viele dieser Erdwerke [waren (d. Verf.)] aber wahrschein- lich keine Befestigungsanlagen. Stattdessen lässt sich ihre Entstehung auch im Kontext einer akephalen Ge- sellschaft erklären.“ (Jeunesse 2010b, 53)

Unter Bezug auf die von ihm als „Gefolgschaftsbestattungen“ insbesondere in der Munzinger Gruppe bezeichneten Befunde, bei denen er in den in sekundären Gräbern Beigesetzten die Opfer von Exekutionen im Rahmen von Totenfolge vermutet (Jeunesse 2010a, 92), spricht er die Möglichkeit der Existenz von Sklaverei⁴ in Gesellschaften ohne institutionelle Hierarchien an (ebd., 95). Gemeinsam mit Ute Seidel formulierte er parallel

„Auch wenn die herausgehobene Stellung unserer Erdwerke unanfechtbar ist, gibt es nach dem derzeitigen Forschungsstand nichts, was dazu zwingt, in der zentralen Stellung der Erdwerke das Abbild einer gesellschaftlichen Hierarchie zu sehen.“

(Jeunesse und Seidel 2010, 68)

Strikt abgelehnt wird die Vorstellung, in den Erdwerken die Residenzen von Häuptlingen zu sehen, die über die umliegenden offenen Wohnsiedlungen geboten werden. Vielmehr war ein Erdwerk ein gemeinschaftliches Bauwerk *„das ein Identitätssymbol für mehrere verstreute Gemeinschaften darstellt“* (ebd.).

Gleichzeitig entwickelte Detlef Gronenborn ein konträres Modell. Er interpretiert die Grabenanlagen im Rhein-Main-Gebiet als große und weitläufige dicht bewohnte Siedlungen (*„mega-sites“*⁵) und leitete daraus eine horizontal in drei Ebenen gegliederte Siedlungshierarchie ab (Gronenborn 2010, 244; Gronenborn *et al.* 2018; Gronenborn *et al.* 2024), die er unter Verweis auf ethnologische Studien als Beleg für komplexe Häuptlingstümer wertete (Abb. 2). Als weiteren Indiz hierfür nahm er Elite-Bestattungen in herausragenden Gräbern in Anspruch, die in Michelsberger Kontext bisher aber nur in frühen Phasen in Frankreich belegt sind (Gronenborn 2010, 245). Die in diesem Zusammenhang angeführten Gräber von Beurieux im Aisne-Tal stehen aber nach Christian Jeunesse in der Tradition der mittelnolithischen Cerny-Kultur und sind mit ihrem Beigabenreichtum typisch für eine vormichelsbergzeitliche Vorstellung des Individuums und seiner sozialen Stellung, die mit dem Beginn von Michelsberg verschwindet (Jeunesse 2010b, 95). Allerdings hat vor kurzem Jean-Paul Demoule (2018) diese Bestattungen wieder Michelsberg zugerechnet. Bemerkenswert ist, dass in zwei Gräbern der Status der Bestatteten u. a. durch die Beigabe von Silexpfeilspitzen ausgedrückt wird, was an die von Johannes Müller herausgearbeiteten Baalberger Inventare erinnert. Für das

offensichtliche Fehlen von Elite-Gräbern in Michelsberg diskutiert Detlef Gronenborn verschiedene mögliche Faktoren: Ursache hierfür könnte der Verlust solcher Bestattungen z. B. durch Erosion, die Artikulation von Status durch Beigaben aus organischem Material, die nicht erhalten sind, oder einfach der Umstand sein

„dass sich die Eliten des mitteleuropäischen Jungneolithikums nicht über Prestigegüter identifizierten und mit ihnen ihre gesellschaftliche Stellung ausdrücken mussten.“
(Gronenborn 2010, 247)

Er verweist auf zwei gegensätzliche theoretische Gesellschaftsmodelle:⁶ eine ausschließende, auf Prestigegüter und Eliten ausgerichtete Strategie, und eine genossenschaftliche Strategie, die auf Einzelhaushalten basiert, große Gemeinschaftswerke kollektiv erbringt und auf die Herstellung von Gemeinschaftssolidarität ausgerichtet ist (ebd., 247–248). In der Realität pendeln Gesellschaften jedoch permanent in zyklischen Entwicklungslinien zwischen diesen beiden Extrempositionen (ebd., 257). Ausgehend von den Kriterien differenziertes Siedlungsgefüge – Elite-Bestattungen – weiträumiger Handel mit Prestigegütern – schließt er unter Verweis auf ethnologische Parallelen auf relativ instabile Häuptlingstümer, die in eine hierarchische Elite, Freie und oftmals auch Rechtlose, Sklaven oder Kriegsgefangene gegliedert waren (ebd., 249).

Für die hier im Zentrum stehenden Frage wichtig ist der Ansatz von Ralf Schwarz für die Baalberger Bestattungen Mitteldeutschlands, am klarsten formuliert in seinen Aufsätzen von 2021 (Schwarz 2021a–d). Darin verfolgte er die Entwicklung sozialer Strukturen quer durch das gesamte Neolithikum, was seine Arbeit von den übrigen hier besprochenen Ansätzen unterscheidet. Am Beginn steht ein methodisch vielschichtiger Bezug auf die ethnologischen Arbeiten zu frühen Gesellschaftsformen (ebd., 217–221). Sehr ausführlich widmete er sich aber auch dem Komplex Baalberge/Salzmünde, also dem Mittelneolithikum in der mitteldeutschen Terminologie (ebd., 230–241). Beide von ihm als Einheit verstandenen Kulturen bzw. Gruppen sind in seiner Wahrnehmung Ackerbauern,⁷ die die fruchtbaren Lössböden bevorzugten (ebd., 230). Die Errichtung der monumentalen Baalberger Erdwerke setzt voraus

„die Koordinierung und Einteilung der Arbeit sowie die Logistik[...] bedürfen der Autorität einer Führungsperson. Ohne Führung und ein gewisses Maß an Autorität

4 Vgl. zur Identifikation von Sklaven in archäologischen Quellen Detlef Gronenborn (2001, 23–28).

5 Zum Begriff *„mega-site“* vgl. Johannes Müller *et al.* (2018).

6 Demographic-structural theory (DST); (vgl. Gronenborn 2016, 64).

7 Vgl. dagegen Robert Ganslmeier (2016, 111), der für Baalberge auch eine Hirtenkultur für möglich hält.

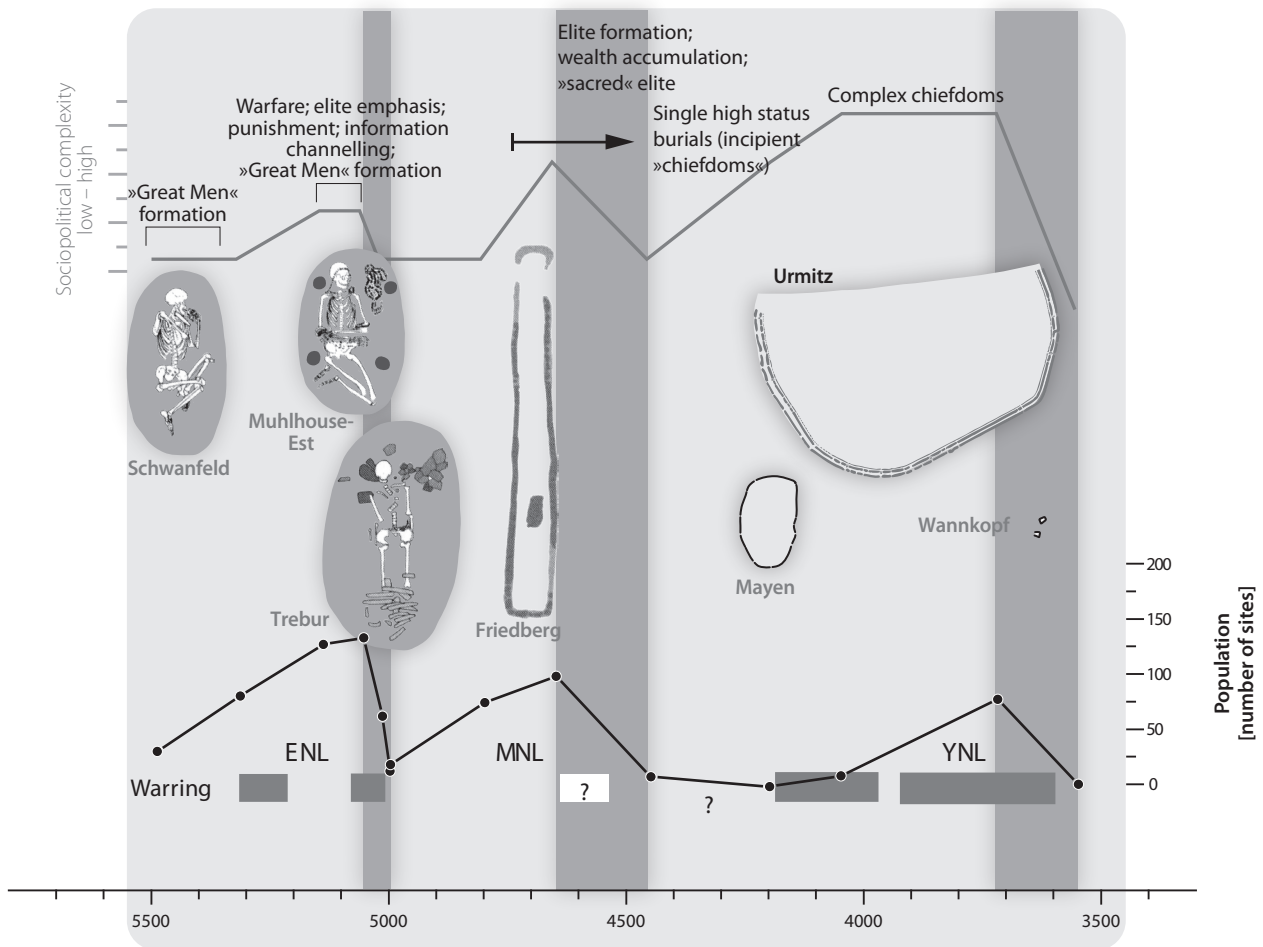


Abb. 2. Das von Detlef Gronenborn entwickelte Modell zeigt die von ihm erschlossenen politischen Führungspersönlichkeiten und die damit verbundenen Formen der politischen Organisation. In der frühen und späten Linienbandkeramik treten "Great Men" auf. Frühe reiche Einzelgräber und deutliche Größenunterschiede zwischen den Siedlungen im Jungneolithikum weisen auf komplexe Häuptlingstümer hin. Die Bevölkerungsdynamik wird durch ein einfaches, heterogenes Proxy (Anzahl der Fundstellen) angedeutet, helle Streifen markieren Phasen des Niedergangs. Abgedruckt mit freundlicher Genehmigung und Unterstützung von Detlef Gronenborn (Gronenborn et al. 2024).

wären solche kollektiven Handlungen nicht möglich gewesen. Um einen Häuptling handelte es sich dabei nicht, da sich anhand der Grabinventare keine Unterschiede erkennen lassen, weshalb der Anführer im Wesentlichen seinen Stammesangehörigen entsprechend bestattet wurde und ihnen deshalb gleichgestellt war.“ (ebd.)

Schwarz weist allerdings auch auf den besonderen Aufwand hin, der mit der Errichtung monumentaler Trapezanlagen (Abb. 3) verbunden war (Schwarz 2021a, 231). Alles spricht für ein in vier Ebenen gegliedertes segmentäres System, an dessen Spitze ein "headman" als Führer eines Clans⁸ stand, zu dessen Verantwortlichkeiten die Einhaltung von Exogamie, die Pflege des Ahnen-

kults und der ihm geheiligten Stätten sowie die Führung in Konflikten zählte (ebd., 232).

„Je nach Organisationsgrad errangen die führenden Personen zusätzlichen Einfluss und Autorität, die über die eines Dorfvorstandes hinausging. Damit wurden die Entscheidungen für kollektive Maßnahmen auf eine höhere Ebene gefällt. Entscheidungsträger dürfte ein Rat aus Dorfvorständen gewesen sein, dem ein Führer leitend vorstand. Insofern dieser nur Kraft seiner Reputation und Fähigkeiten seinen Einfluss bei Entscheidungen geltend machen konnte und keine Befehlsgewalt besaß, handelte es sich bei ihm um einen headmann.“ (ebd.)

8 „Führer eines Stammes oder einer ähnlichen Gruppe der keine präzise spezifizierte Autorität besitzt, sondern sich

weitgehend auf seinen persönlichen Einfluss stützt.“ (Schwarz 2021a, 218 unter Bezug auf Lewis 1982, 273)



Abb. 3. Die ca. 90 m lange monumentale Trapezanlage von Drosa, Ldkr. Anhalt Bitterfeld (Sachsen-Anhalt). Die beiden Nord-Süd-Gräber ganz im Osten und das Grab in der Nähe des westlichen Abschlusses sind Primärgräber. Bei den beiden Nord-Südgräbern handelt es sich um Nachbestattungen. © LDA Sachsen-Anhalt (Schwarz 2021b, 412 Abb. 8).

Darunter stehen die von den Ältesten geführten maximalen *lineages*, die verantwortlich sind für die Verteilung der Anbauflächen und damit der Produktion, die Oberhäupter der Gehöfte, die die Verteilung des Speicherguts regeln und schließlich die von den Müttern geführten Kernfamilien. Allerdings:

„Unterzieht man die von Sahlins geschilderte Prämissen für die big men Melanesiens einem Vergleich mit den aus archäologischen Quellen erschließbaren Verhältnissen der mittelnolithischen Gesellschaften, dann kann nicht davon ausgegangen werden, dass big men die nötigen Ressourcen und Arbeitsleistungen bereitzustellen in der Lage gewesen wären, derart monumentale Erdwerke, wie sie für die BAK und SMK⁹ kennzeichnend sind, zu erbauen.“ (Schwarz 2021a, 235)

Deshalb betonte Schwarz, dass nur „*headman*“ als Oberhäupter von Clans, bestehend aus mehreren *lineages* oder ethnischen Gruppe in der Lage waren, die erforderlichen Ressourcen zu mobilisieren (ebd., 236). Er postuliert damit eine Führungselite, die abgesehen von ihrer institutionellen Verankerung auf der Ebene der

„*Chiefs*“ angesiedelt ist, insbesondere was die von ihr potenziell zu mobilisierenden Arbeitskräfte betrifft. Auch für Salzmünde stellt das Fehlen von Elite-Bestattungen ein Problem dar:

„Betrachtet man wieder die teilweise enorme Größe der Befestigungen, sind Personen mit Entscheidungskompetenzen innerhalb der Gesellschaft der SMK zwingend erforderlich gewesen, die, um solche Bauprojekte durchzusetzen und zu organisieren, dazu notwendige Druckmittel besessen haben müssen. Unterschiede im Grabkontext sind allerdings auch in der SMK nicht auszumachen.“ (Schwarz 2021a, 238)

Die Diskussion scheint festgefahren. Der Komplex Michelsberg-Baalberge/Salzmünde stellt sich sozialhistorisch verstanden in den archäologischen Quellen aufgrund des Fehlens von Elite-Bestattungen entweder dar als eine segmentäre akephale Gesellschaft, innerhalb derer sich maximal eine Unterschicht, aber keine stabile Elite nachweisen lässt. Letztere ist aber offenbar die Voraussetzung für die Errichtung monumentaler Erdwerke. Oder es existierte eine wenn auch

9 BAK = Baalberger Kultur; SMK = Salzmünder Kultur



Abb. 4. Der Trapezgraben von Porta-Westfalica-Lerbeck im Planum und negativ ausgenommen (Pollmann 2022, 26 Abb. 1).

instabile Elite oberhalb der Ebene der *lineages*, die sich aber nicht in den Bestattungen widerspiegelt. Also: *Too many Indians, and not enough Chiefs?*

Eher schattenhaft ist die Spur der mit Silexpfeilspitzen ausgestattete Gräber, die ganz im Westen einsetzt mit den Bestattungen vom Type Beurieux (Demoule 2018, 293–296), wo sie mit ost-west-orientierten Trapezanlagen verbunden sind, deren Ausstattung mit Pfeilspitzen den von Johannes Müller angeführten ähnlich ausgestatteten Baalberger Gräbern ähnelt und die auch von Ralf Schwarz ins Spiel gebracht wurden.¹⁰ Chronologisch und räumlich liegt dazwischen jedoch eine zunächst fast unüberbrückbar erscheinende Lücke. Allerdings deutet die Tradition der Errichtung von Trapezanlagen vielleicht doch auch verbindende Elemente an (Ganslmeier 2016, 104; Midgley 2006). Martin

Nadler hat auf ihr wenn auch vereinzelt Vorkommen in Süddeutschland hingewiesen (Nadler 2016). Eine bei Friedberg im Wetteraukreis gegrabene Anlage wurde in denselben Kontext gestellt (Schade-Lindig 2008). Dass es sich bei den Gräbern vom Typ Beurieux um doch vielleicht mehr als ein rein ostfranzösisches Phänomen handelt, zeigt die 2021 in Porta-Westfalica-Lerbeck entdeckte ost-west-orientierte Trapezanlage mit einem Körpergrab (Pollmann und Rüdiger 2022), das in Baalberger Manier im Osten des Trapezes liegt (Abb. 4). Mit seinem Inventar aus herzförmigen flächenretuschierten Pfeilspitzen und Querschneidern (Abb. 5) bildet es eine direkte Parallele zu den Gräbern in Beurieux (Demoule 2018, Abb. 7b und 7f). Für den beigegebenen Becher¹¹ mit unter dem Rand umlaufender Reihe dreieckiger Einstiche konnten Hans-Otto

¹⁰ Vgl. Schwarz 2021a, 234; Schwarz 2013; Schwarz 2021, 236 unter Bezug auf Salzmünde.

¹¹ In der Publikation von 2022 weisen Hans-Otto Pollmann und Jasmin Rüdiger dem Grab auch die Randscherbe eines Steilhalsgefäßes zu. Da diese Zuordnung vermutlich

auf einem Fehler beruht, wurde die Scherbe aus Abb. 5 gelöscht. Freundlicher Hinweis von Hans-Otto Pollmann, dem ich auch für die Erlaubnis zum Abdruck des Befundes und des Grabinventars danke.

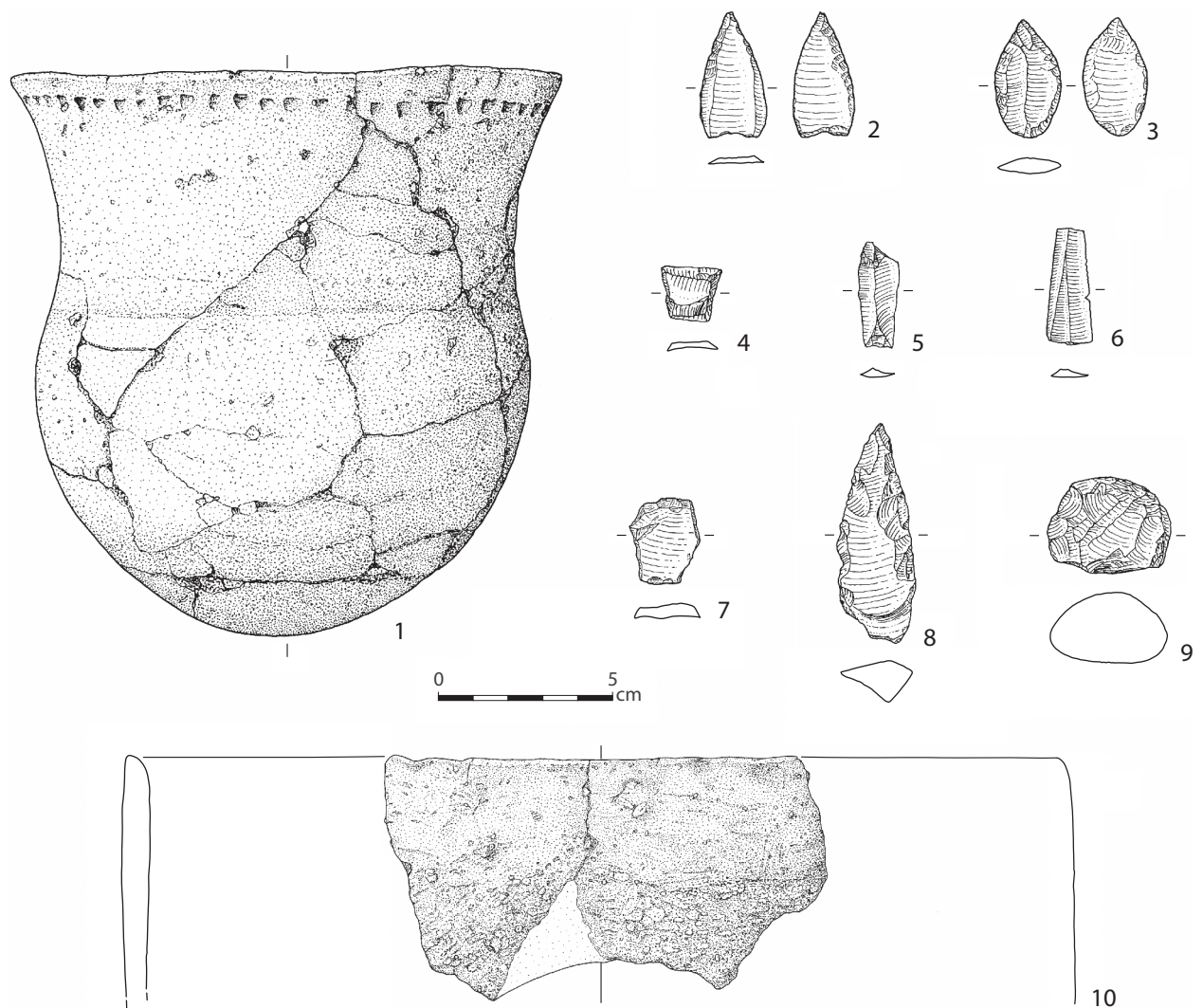


Abb. 5. Das Grabinventar der Körperbestattung im Osten des Trapezgrabens von Lerbeck. 1 Keramik, 2–9 Silex (nach Pollmann 2022, 28 Abb. 3).

Pollmann und Jasmin Rüdiger (2022, 28) eine Parallele aus der Siedlung Hüde I am Dümmer anführen, so dass sie die Trapezanlage in „ein(en) mesolithisch-neolithischen Übergangshorizont“ einordneten. Von seiner Grundform her zeigt das Gefäß Ähnlichkeiten zu Michelsberger Tulpenbechern. Sehr gute Parallelen liegen aus dem Erdwerk von Müsleringen, Ldkr. Nienburg, an der Mittelweser vor, die von Alexandra Philippi in einem Spannungsfeld zwischen Michelsberg, Swifterbant und frühester Trichterbecherkultur diskutiert werden (Philippi 2023, 49–117, bes. Abb. 22). Es gibt für Lerbeck drei sehr dicht beieinanderliegende ^{14}C -Daten, (Pollmann und Rüdiger 2022, 28) die trotz des ungünstigen Verlaufs der Kalibrationskurve das Grab sicher in die Zeit zwischen 4450 und 4350 cal BC datieren (Abb. 6), und damit früher als die Funde aus Müsleringen sind (Philippi 2023, 81). Bezogen auf Mitteldeutschland stellt sich die Frage, ob nicht auch für

die Schiepziger Gruppe mit Trapezanlagen zu rechnen ist analog zu den für diese mittlerweile belegten Erdwerken (Müller *et al.* 2019).

Die Frage nach Michelsberger Elite-Bestattungen bleibt beim gegenwärtigen Forschungsstand weiter offen. Für Baalberge stellt Robert Ganslmeier egalitär ausgestattete Gräber fest und allenfalls im Aufwand für die Errichtung von großen Trapezanlagen spiegeln sich Personen wider, die er vorsichtig als „prominent“ bezeichnet und in denen er die Oberhäupter von Familien oder Verwandtschaften vermutet (Ganslmeier 2016, 110–112). Demgegenüber findet sich bei Ralf Schwarz eine Deutung, die sein geschildertes Modell einer gegliederten Baalberger Gesellschaft aufgreift. Er differenziert die Trapezanlagen grob in vier Größenklassen: Kleine Anlagen unter 15 m Länge, Standardgröße 15–25 m, große Anlagen 30–50 m, sowie monumentale Anlagen 50–80 m“ (Schwarz 2021b, 411).

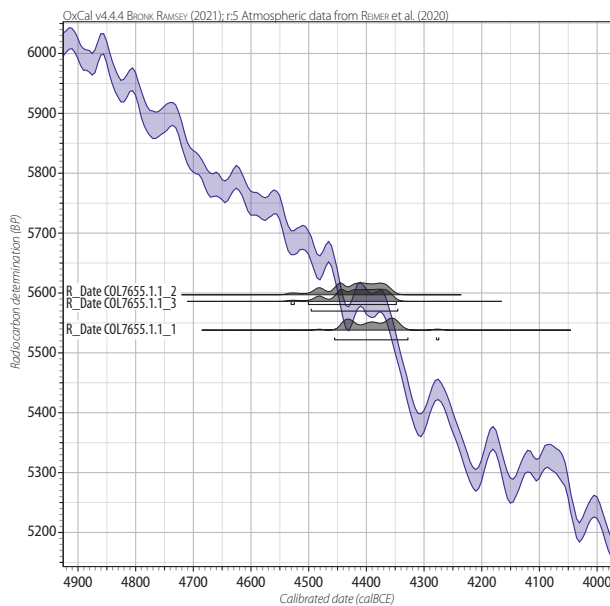


Abb. 6. Die ^{14}C -Daten (Holzkohle, Eiche) aus Lerbeck kalibriert (Daten nach Pollmann 2022, 28).

„Auch wenn die Beigaben keine Unterschiede erkennen lassen,¹² steht doch der für die Errichtung der Grabanlagen notwendige Arbeitsaufwand weit über dem ein-

facher Gräber und lässt die hohe Wertschätzung, die solchen Personen im Leben und über den Tod hinaus zu Teil wurde, erahnen“ ... „Man darf deshalb in den mit erheblichem gemeinschaftlichen Aufwand errichteten Grabmonumenten — den großen und monumental Trapezanlagen — die Bestattungsplätze besonderer Würdenträger oder Funktionsträger, z.B. als headman oder big man — für einen Häuptling fehlen im archäologischen Befund alle Voraussetzungen — erblicken. Die Größe der Anlagen und die für den Bau notwendige Zahl an Personen könnten darüber hinaus Unterschiede im Prestige der Toten widerspiegeln.“ ... „Ausschlaggebend für die Ausübung einer leitenden Funktion innerhalb der Gesellschaft waren besondere Begabungen, die dem Wohl der Gemeinschaft nützen: soziale und politische Kompetenz, wirtschaftlicher Erfolg, Klugheit, Besonnenheit, Tapferkeit etc. Für die Besetzung solcher Funktionen in egalitären Stammesgesellschaften, wie sie während des Neolithikums in Mitteleuropa verbreitet waren, waren solche Fähigkeiten entscheidend. Sicherlich trachteten die einzelnen Familien danach, ein solches Amt zu erwerben und dauerhaft zu besetzen, waren doch mit solchen Ämtern auch ideelle (Prestige) und materielle Vorteile (etwa Zugang zu besonderen Gütern) verbunden, von denen auch die Familie oder der Clan profitierten.“ (ebd., 416)

ERDWERKE UND DIE SOZIALEN STRUKTUREN DAHINTER

An dieser Stelle ist es sinnvoll, die Perspektive zu wechseln: Wie beurteilen die Bearbeiter von jung- bzw. mittelneolithischen Erdwerken die soziale Struktur der Gruppen, die diese errichteten und nutzten?

Es gibt vergleichsweise wenige Arbeiten, die ausgehend von dem großräumig betrachteten Phänomen „Erdwerke“ die Frage nach der dahinterstehenden sozialen Gruppierung aufgreifen. Ein älteres Beispiel ist der methodisch sehr differenzierte Ansatz von Francois Bertemes aus dem Jahr 1991, der vor allem auf die Diskussion der Funktion der behandelten Anlagen abzielt (Bertemes 1991). Zur hinter ihrer Erbauung zu erschließenden Bevölkerung vermutete er:

„ein überregional durchorganisiertes Siedlungssystem mit in einem gewissen Abstand voneinander liegenden zentralen Kultstellen. Sie drücken damit ein vom Neolithikum¹³ her unbekanntes Gruppenzusammengehörigkeitsgefühl der Bewohner einzelner Regionen aus. Man

kann davon ausgehen, dass diese Kultstellen gleichzeitig politische Versammlungsorte regionaler und überregionaler Bedeutung waren. Zudem liefern sie den indirekten Beweis einer komplexen Sozialstruktur. Zentrale Anlagen sind nur dann möglich, wenn sie auch zentral geplant werden. Ihre Erbauung bedarf einer wie auch immer gearteten zentralen Organisation. Die aufwendigen Anlagen waren sicherlich auch ein Symbol für den Reichtum und die Macht der jeweiligen Bevölkerungsgruppe.“ (Bertemes 1991, 456)

In ähnlicher Richtung argumentierte Dirk Raetz-Fabian:

„Die Errichtung monumentaler Erdwerke erfolgt in Phasen kultureller Neuformierung. Der Arbeitsaufwand setzt eine hohe Motivation, das Vorhandensein bzw. das Potential für die Entwicklung einer leistungsfähigen Infrastruktur und die Beteiligung eines größeren

12 Hier ergibt sich eine Unwägbarkeit, da bislang nur Bestattungen zweier monumentaler Trapeze gegraben wurden (Halle-Dölauer Heide Hügel 6 und Lederbogenschers Mühlenberg), wobei das Grab von der Dölauer Heide zu

den Bestattungen mit Silxpfleispitzen in unmittelbarer Nähe von Erdwerken zählt (Schwarz 2021b, 412).

13 Bertemes fasst im Sinn des Tagungsbandes Jung- bzw. Mittel- und Spätneolithikum zusammen als „Kupferzeit“.

Sozialverbandes voraus. Hieraus ist auf eine integrative, konsolidierende Funktion für die einbezogenen Gemeinschaften zu schließen. (Raetzel-Fabian 1999, 106)

Jörg Eckerts Bearbeitung von Mayen war die erste moderne Bearbeitung eines Erdwerks (Eckert 1992). Erst ganz am Ende seiner Studie stellte er die Frage nach der mit dem Erdwerk verbundenen Bevölkerung und deren Struktur: Er weist darauf hin

„... dass aus der Existenz und Errichtung eines Erdwerks nicht zwingend eine hierarchische Gesellschaftsstruktur folgt. Es konnte vielmehr gezeigt werden, dass es sich um die Arbeit mehrerer verschiedener Gruppen gehandelt hat. Die vermeintlich gewaltige Arbeitsleistung, die, wie manche Autoren glaubten, nur unter einer Zentralgewalt zu erbringen gewesen war, ist wesentlich geringer gewesen, als früher vorausgesetzt wurde, war also durchaus im Rahmen einer bäuerlichen Kooperation möglich, ja wahrscheinlich. Selbst bei der großen Anlage von Urmitz reduziert sich der Arbeitsaufwand erheblich, wenn man die verschiedenen Bauphasen in ihrer

zeitlichen Abfolge sieht, auch wenn die Gesamtleistung noch eindrucksvoll genug bleibt.“ (Eckert 1992, 184)

Erstaunlicherweise gingen in der Folge Daniel Schyle (1997), Dirk Raetzel-Fabian (2000) und Susanne Reiter (2005) dieser Frage aus dem Weg. Erst Ute Seidel wagte sich interpretativ wieder vor:

„dass mit den Erdwerken erste Ansätze zu stadtartigen Siedlungen im westlichen Mitteleuropa fassbar sind, scheint bei Annahme einer eher kurzzeitigen Nutzung fraglich. Vorstellbar ist jedoch unabhängig davon eine Funktion als politischer und/oder religiöser Mittelpunkt. Einer zentralörtlichen Funktion steht nicht im Wege, dass sich in bestimmten Regionen eine Häufung mehrerer Erdwerke auf engem Raum findet“ [...] „auch aufgrund der investierten Arbeitsleistung scheint es möglich, dass die Erdwerke im Zeitrahmen der Gründung einer Siedlung angelegt wurden. Dies spricht dafür, dass den Erdwerken eine Stellung innerhalb eines wenig ortsfesten Siedlungsgefüges zukam.“

(Seidel 2008, 385)

ZUSAMMENFASSUNG

Insgesamt erweist sich das Ergebnis der Literaturrecherche als ambivalent: viele derer, die sich im Rahmen einer Analyse jung- bzw. mittelnolithischer Sozialstrukturen mit dem Phänomen „Erdwerke“ auseinandersetzen, als auch derjenigen, die ausgehend von der Beschäftigung mit Erdwerken nach den dahinter liegenden sozialen Strukturen fragen, gelangten zum Modell segmentierte Gesellschaften ohne institutionalisierte Formen von Herrschaft auf einer die Ebene oberhalb von *lineages* bzw. Familienverbänden. Ausschlaggebend hierfür ist das Fehlen von Elite-Bestattungen. Für Baalberge ist es möglich, über überproportionalen Aufwand für die Errichtung von Trapezgräben oder durch die Identifikation von Bestattungen mit herausgehobenen Grabinventaren und räumlichem Bezug zu Erdwerken eine herausgehobene Bevölkerungsgruppe zu umschreiben, deren Einordnung nach archäologischen Kriterien aber unklar bleibt. Allerdings erscheint sowohl die Anzahl der monumentalen Trapezgräben als auch die der angeführten Grabinventare in Relation zur mittlerweile bekannten Zahl an Erdwerken gering zu sein. Der Arbeitsaufwand für die Errichtung von Erdwerken ist dagegen hoch und es bleibt unsicher, ob er von derartigen Gemeinschaften erbracht worden sein kann. Es muss damit gerechnet werden, dass verschiedene soziale Verbände gemeinsam eine solche Anlage in vergleichsweise kurzer Zeit errichteten und danach auch nutzten.

Das alternative, vor allem von Detlef Gronenborn vertretene Modell, das entwickelte Häuptlingstümer

postuliert, steht abgesehen von dem Fehlen von Elite-Gräbern vor dem Problem, dass es sich bei den zugrunde gelegten Plätzen wie dem Kapellenberg nicht um Erdwerke im hier vertretenen Sinn, sondern um befestigte Höhensiedlungen handelt, deren Erforschung noch am Anfang steht und für die noch der Beleg aussteht, dass es sich um dicht bebaute „*mega-sites*“ gehandelt hat. Ralf Schwarz, der mit dem Begriff „*headman*“ anstelle von „*chief*“ operiert, versucht dagegen so die Reduktion der Darstellung von Status auf den für das Grab erbrachten Aufwand zu erklären. Das klingt plausibel, müsste aber im Einzelfall belegt werden und ändert letztlich nichts an der Annahme einer übergeordneten personellen Ebene, die in der Lage gewesen ist, Bevölkerungseinheiten, die sich aus mehreren *lineages* zusammensetzen, zu koordinieren. Ob sich das Austauschen des Begriffs „*chiefs*“ durch den des „*headman*“ in der archäologischen Wahrnehmung ablesen lässt, bleibt dabei eine offene Frage.

In der Region Braunschweig wird gegenwärtig eine Erdwerkslandschaft mit zahlreichen gleichzeitigen, z. T. nur 3,5 km voneinander entfernten monumentalen Erdwerken untersucht. Keines der beiden skizzierten Modelle lässt sich auf dieses Verbreitungsbild ohne weiteres übertragen. Weder *Chiefs* noch *Headman* bleibt ausreichender Raum, um sich und die ihnen zuzuordnenden Gruppen aufzustellen. Es muss nach Stellschrauben gesucht werden, um die skizzierten Parameter anders zu justieren (Geschwinde 2018, 275–277).

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Very Large Buildings

A New Category of Monumental Structures in Late European Prehistory: The Case of Western France

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KEYWORDS: Neolithic architecture, monumentalism, Artenac, Tripolje

Abstract

Because of their spectacular dimensions, the monumental architectures discovered over the last forty years or so in the French Late-Final Neolithic (3400–2500 BCE) and in the Late Chalcolithic of the Ukrainian-Moldavian zone (4100–3600 BCE) are clearly distinct from anything traditionally known as “large houses”. We propose here to assign these manifestations of hyper-monumentalism to a new category for which we suggest to use the concept of “Very Large Building” (VLB). The buildings concerned belong to two main corpora: the first, located in Western and Central France, dates from the Final Neolithic and is linked to the Artenacian culture and its satellites; the second is comprised of some of the ‘mega-structures’ discovered within the very large settlements (‘mega-sites’) of the Tripolje culture. In addition, there are three secondary assemblages located in the northern half of France, belonging to the Cerny (Beaurieux) and Michelsberg (Mairy) cultures, and the Late Neolithic of the middle Seine Valley (Pont-sur-Seine). As these Neo-Chalcolithic buildings are difficult to interpret on the basis of archaeological observations alone, we

have made a diversion via the VLBs described by ethnologists for pre-state, pre-literary and pre-urban societies, both current and sub-current. The buildings in question are studied from the angle of their architectural features, their relationship to other buildings in the settlements of which they form a part, and their socio-political context. The data collected is then used to consider the problem of the function of the Neo-Chalcolithic VLBs in Europe. While the debate remains wide open for the secondary corpora and, for other reasons, for the mega-structures of the Tripolje culture, we believe that we have sufficiently solid arguments to propose that the Late Neolithic VLBs of Western Europe were aristocratic residences testifying to the existence of stratified societies. The emergence of such societies, the oldest of which date from the middle of the 5th millennium, would therefore be manifested either through the appearance of very rich tombs, generally monumental, or through the construction of hyper-monumental domestic buildings designed to serve as residences for the elites of stratified societies of the ‘complex chiefdom’ type.

Zusammenfassung

Aufgrund ihrer spektakulären Größe unterscheiden sich die monumentalen Architekturen, die in den letzten etwa vierzig Jahren im französischen Spätneolithikum (3400–2500 v. Chr.) und im Spätchalkolithikum der ukrainisch-moldawischen Zone (4100–3600 v. Chr.) entdeckt wurden, deutlich von allem, was traditionell als „große Häuser“ bezeichnet wird. Wir schlagen hier vor, diese Erscheinungsformen des ‚Hypermonumentalismus‘ einer neuen Kategorie zuzuordnen, für die wir den Begriff „Very Large Building“ (VLB) verwenden wollen. Die betreffenden Bauten gehören zu zwei Hauptkorpora: Das erste, in West- und Zentralfrankreich

gelegene, stammt aus dem Endneolithikum und ist mit der Artenac-Kultur und ihren Nachbargruppen verbunden; das zweite umfasst einige der „Mega-strukturen“, die innerhalb der Mega-sites der Tripolje-Kultur entdeckt wurden. Darüber hinaus gibt es drei sekundäre Fundstellen in der nördlichen Hälfte Frankreichs, die zu den Kulturen von Cerny (Beaurieux) und Michelsberg (Mairy) sowie zum Spätneolithikum des mittleren Seine-Tals (Pont-sur-Seine) gehören. Da diese neo-chalkolithischen Bauten allein auf der Grundlage archäologischer Beobachtungen nur schwer zu interpretieren sind, haben wir einen Umweg über die von Ethnologen

beschriebenen VLBs für vorstaatliche, vorliterarische und vorstädtische Gesellschaften, sowohl aktuelle als auch subaktuelle, gemacht. Die betreffenden Gebäude werden unter dem Gesichtspunkt ihrer architektonischen Merkmale, ihrer Beziehung zu anderen Gebäuden in den Siedlungen, zu denen sie gehören, und ihres sozio-politischen Kontextes untersucht. Die gesammelten Daten werden verwendet, um die Funktion der neo-chalkolithischen VLBs in Europa zu untersuchen. Während die Debatte über die Sekundärkorpuse und — aus anderen Gründen — über die Mega-strukturen der Tripolje-Kultur offen bleibt, glauben wir, über

ausreichend solide Argumente zu verfügen, um vorzuschlagen, dass die spätneolithischen VLBs Westeuropas aristokratische Residenzen waren, die von der Existenz geschichteter Gesellschaften zeugen. Die Entstehung solcher Gesellschaften, von denen die ältesten in die Mitte des 5. Jahrtausends datieren, würde sich demnach entweder durch das Auftreten sehr reicher, meist monumentaler Gräber oder durch die Errichtung hypermonumentaler Wohnbauten manifestieren, die als Residenzen der Eliten stratifizierter Gesellschaften vom Typ „komplexes Häuptlingstum“ dienen.

INTRODUCTION

In studies of dwellings in prehistoric Europe, the first distinction that spontaneously springs to mind is that between the small houses of the Circum-Alpine Wetland Neolithic or the Chalcolithic tells of the Carpathian-Balkan domain and the large houses of the Danubian Neolithic or the Central European Early Bronze Age. The former cover areas of no more than a few dozen square metres; the Schussenried House of Culture, for example, at an average of 25 m², is well above the average for its category. The second group consists of long, narrow, rectangular or trapezoidal buildings, which can be up to 70 m long and cover an area of almost 500 m².¹ In the group of “large houses”, the hypothesis of a domestic function is only properly supported in the Danubian Neolithic. Insofar as it is only plausible for Early Bronze Age buildings, we prefer to use the term “Large Buildings” (LB) to designate the architectural category that groups together these two sub-corpora. The figure of 500 m² will be used as a provisional upper limit for the surface of LBs. More work needs to be done on how they differ from small lake-dwelling and Chalcolithic buildings. However, this article has another objective, namely to compare the LB with a new category that has burst onto the scene of Neolithic research over the last thirty years or so, that of the “very large buildings” (VLB), whose surface area exceeds 500 m², often exceeding the 1000 m² threshold.

This movement began in the 1980s with the discovery of a first group of VLBs, dated to the 3rd millennium, in western France, which will be discussed in this article, and continued in the 2000s with the discovery of ‘mega-structures’ on the Ukrainian Chalcolithic mega-sites. These very large ellipsoidal settlements, dated to between 4100 and 3600 BCE, are now sufficiently well known for us to dispense with a detailed description.² They comprise up to 1,750 buildings and are subdivided into neighbourhoods each containing a “mega-structure” interpreted as a community building, a “club- or assembly house” (Müller *et al.* 2022, 79). One of these has been excavated at Nebelivka. It represents a total of 1,200 m², including 800 m² of covered space and a courtyard of 400 m²; The contrast with the “ordinary” houses in the same settlement, which are no larger than a hundred square metres, is spectacular.

The west and north of France have produced four bodies of VLBs, which we will describe in turn. The largest are the so-called “Antran-type” buildings (3rd millennium). The other three come from just one site each, namely Beurieux (Cerny Culture), Mairy (Michelsberg Culture) and Pont-sur-Seine (Late Neolithic) (Fig. 1). A diversion into ethnology will then provide the backbone for a brief discussion of the function and social significance of VLBs.

1 The largest houses from the Danube Neolithic and Early Bronze Age: Schwabhausen, Thuringia, 71 x 6, 426 m² (*Lienbankeramik*, Pechtl 2009; Grasselt 2000); Bochum-Hiltrop, North Rhine-Westphalia, 64.5 x 8.0 m max. width, c. 450 m² (Roessen, Hampel 1989); Dermsdorf, Thuringia,

44 x 11 m, 488 m² (Ünétice, Küssner 2023); Zwenckau, Saxony, House 26, 56.6 x 8.6 m, 487 m² (Ünétice, Risch *et al.* 2021).

2 Latest synthesis, with bibliography: Müller *et al.* 2022.

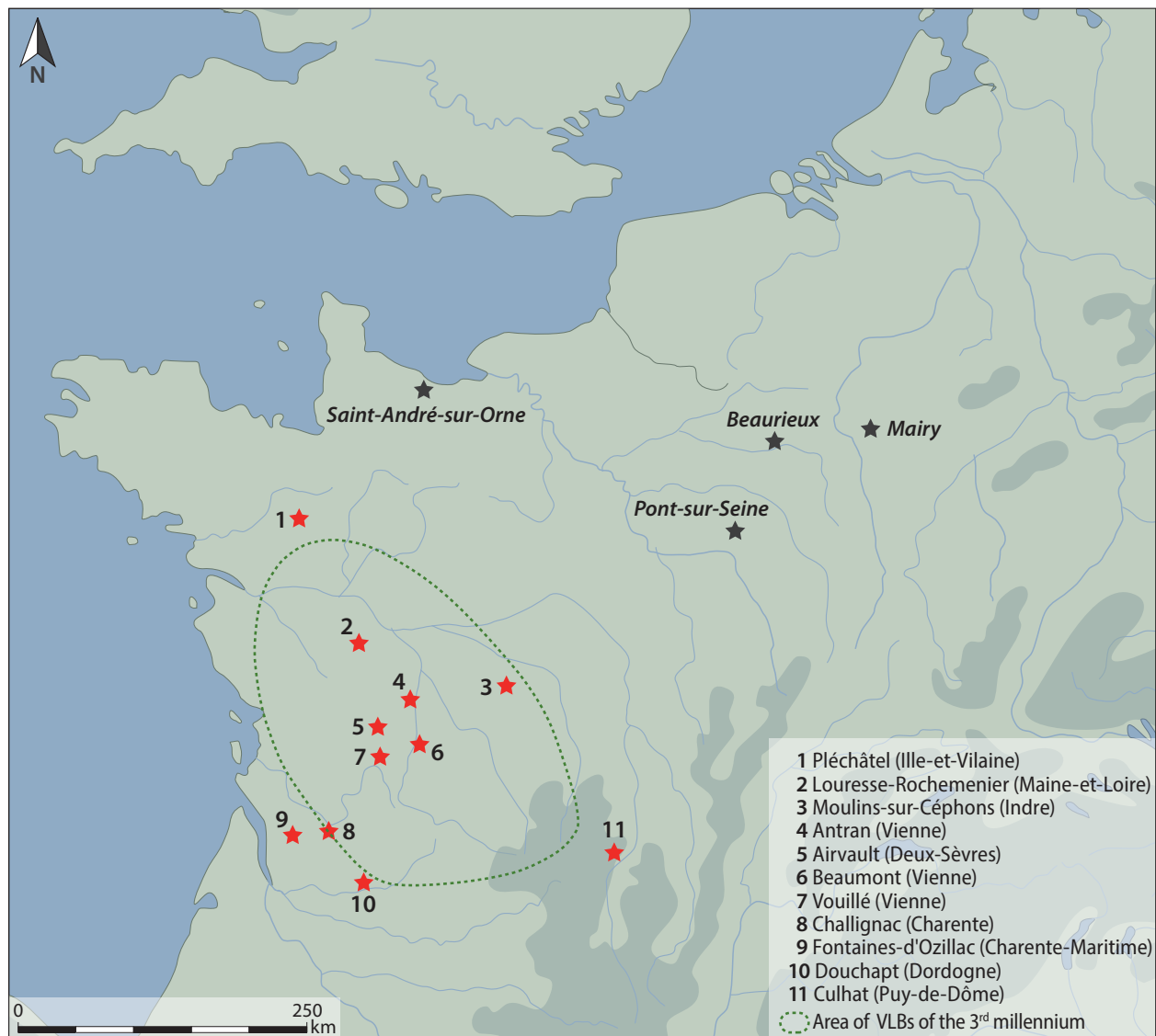


Fig. 1. Location of sites mentioned in the article (Map: Karin Winter).

VLBS IN WESTERN FRANCE

Research into the VLBS of western France began with the discovery of the building at Antran (Vienne) (Pautreau 1984)³ and discoveries were then made regularly until the most recent, at Culhat (Puy-de-Dôme, Denaire *et al.* 2020). Sixteen buildings, belonging to 11 sites, have been discovered, several of which exceed 100m in length; the largest is that at Ozillac (Charente-Maritime), which is 150m long by 19m wide and covers an area of 2,850m² (Fouéré *et al.* 2013). Most of the sites are in western France, between the Loire

and the lower Garonne rivers. Two outlying sites (Pléchâtel and Culhat) show a larger territory reaching central France to the east and inland Brittany to the north. The mega-houses are dated between 2900 and 2200 BCE and belong to the Artenac Culture or to culturally linked small groups of its periphery. The site of Pléchâtel is dated around 2700 BCE by one dendro-date (2719–2699) and two radiocarbon dates.⁴ In Moulins-sur-Céphons (Indre), four dates fall within the range between 2880–2670 BCE (Hamon *et al.* 2014).

3 Discovered in 1984, the building was not recognised as Neolithic until around ten years later (Pautreau 1994).

4 Gif-9119: 4070 ± 50 BP 2862–2470 cal BC – 2σ; Gif-964: 4290 ± 50 BP 3081–2702 cal BC – 2σ (Tinevez 2004).

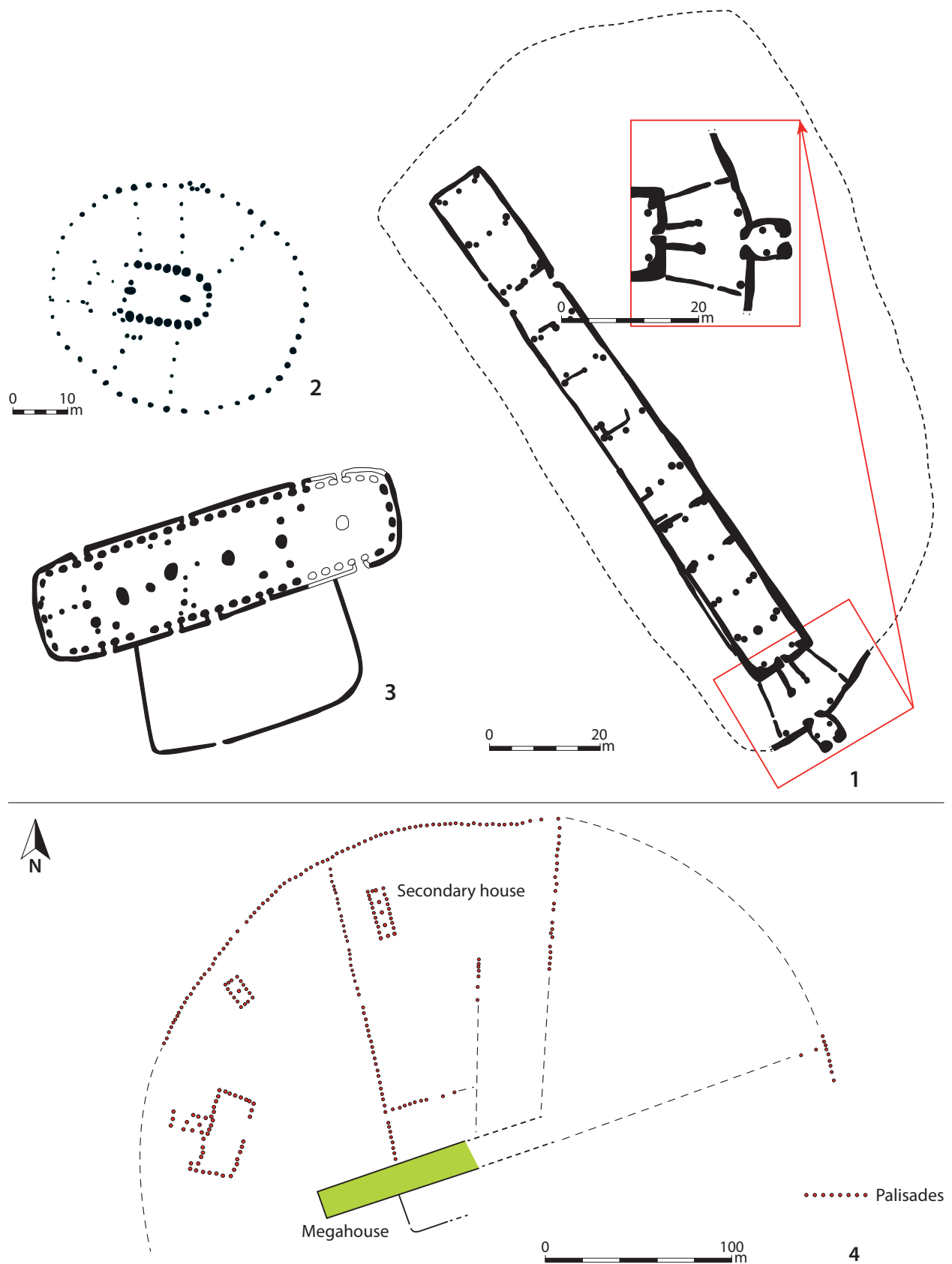


Fig. 2. Very large Final Neolithic buildings in western France. 1 Pléchâtel (after Tinevez 2004); 2 Saint-André-sur-Orne (after Ghesquière et al. 2019); 3 Douchapt (after Fouéré et al. 2018); 4 Moulins-sur-Céphons (simplified plan based on Hamon et al. 2018).

The results obtained in Douchapt (Dordogne)⁵ and Antran⁶ confirm this image. The highest probability lies between 2900 and 2500 BCE, i.e., a time-span corresponding to the first, pre-Beaker, stage of the Arènes Culture. The phenomenon of the VLB of Western France would thus postdate the period of construction of the second wave of megalithic graves in the same area (second half of the fourth millennium) and predate the emergence of the Bell Beaker Culture.

The buildings are rectangular in plan, sometimes with slightly curved walls and rounded corners, as at Douchapt (Dordogne). The larger of the two houses on this site is 75 m long and up to 18 m wide, covering a surface area of 1,350 m², with an estimated minimum height of 13.50 m (Figs. 2, 3). The interior is divided in two by an axial row of powerful posts. In Moulins-sur-Céphons (Indre), for instance, the holes of these central post can reach more than two metres in diameter and 2.50 m in depth (Hamon *et al.* 2014). The outer walls may be double or even triple, with a row of inner posts complemented by one or two walls set in continuous foundation ditches. Another recurring feature is a small enclosure attached to one of the long sides. Especially impressive is the width of the buildings: as all architects know, it is quite easy, even with the help of traditional techniques and materials, to build a 100 metres long houses with 8 m width, but far more difficult to reach widths of 12–19 m.

When a sufficiently large area is excavated, one can see that the building is located inside a palisaded ditch,

with which it is sometimes linked by divergent palisades. This pattern (house, enclosure, divergent post rows and outer palisade) has been identified in Moulins-sur-Céphons, Pléchâtel and Douchapt but recent researches suggest that it could be systematic (Maitay *et al.* 2018, 642). At Pléchâtel, a monumental double entrance, probably for defensive purposes, provided access to the enclosure and the building (Fig. 2.1). Smaller buildings, possibly located within the enclosure as at Moulins-sur-Céphons (Fig. 2.4), complete the layout in cases where it has been possible to study the immediate surroundings of the VLB,⁷ even if, of course, their chronological relationship with it remains difficult to elucidate with any precision. The overall picture, then, is of a VLB surrounded by an enclosure and set amidst a cluster of widely-spaced buildings of much smaller size. The combination specific to the central part of this layout (a building linked to a palisaded enclosure by radiating palisades) is not exclusive to VLBs. The site at Saint-André-sur-Orne (Calvados), dated between 2900 and 2400 BC, illustrates the existence, on the periphery of the VLB's territory, of a more modest version, with a central building of no more than 200 m², which places it more in the LB category (Fig. 2.2). While most of the sites have only one VLB, some have several, and in at least two cases there are sequences of successive VLBs. This is the case, in particular, at Douchapt and Pléchâtel, where the enormous amount of work involved in building a VLB was reproduced at least twice in a row in the same place.

OLDER MONUMENTAL BUILDINGS AT BEAURIEUX, MAIRY AND PONT-SUR-SEINE

Although the Late Neolithic VLBs are by far the most spectacular, the north of France has produced other very large, older buildings at the Beaurieux, Mairy and Pont-sur-Seine sites.

Beaurieux (Aisne)

At Beaurieux (Colas *et al.* 2018), a trapezoidal building with three rows of postholes and a west-east orientation was attributed to the Cerny Culture (4800–4400/4300 BCE) (Fig. 3.1). Its length exceeds 80 m if we consider that the 20 m long row of postholes packed close together at the eastern end is an integral

part of the building. If this is excluded, the result is a building 73 m long and 6–13 m wide, with a surface area of around 760 m². However, the possible existence of external walls that have not been preserved and disturbances on the west side leave open the possibility of an even larger building. This building is the only one to have been found on a site that also contains poorly preserved remains of long mounds also attributed to the Cerny Culture. It is also a unicum within this culture, which is otherwise poor in architectural remains and whose most spectacular structures were, until the discovery of the Beaurieux building, circular in plan. No remains have been found that can be linked to the building's function.

5 Gif-10473: 3965 ± 60 BP, 2831 – 2236 cal BC – 2 σ; Gif-10472: 3980 ± 60 BP 2834–2292 cal BC – 2 σ (Roussot-Laroque 2014).

6 Gif-9610: 4150 ± 70 BP 2888–2500 cal BC – 2 σ; Gif-9611: 4120 ± 55 BP 2876–2499 cal BC – 2 σ (Pautreau 1994).

7 At Moulins-sur-Céphons (Hamon *et al.* 2018) and Vouillé (Denaire *et al.* 2020), these are rectangular buildings on poles that can be around thirty metres long.

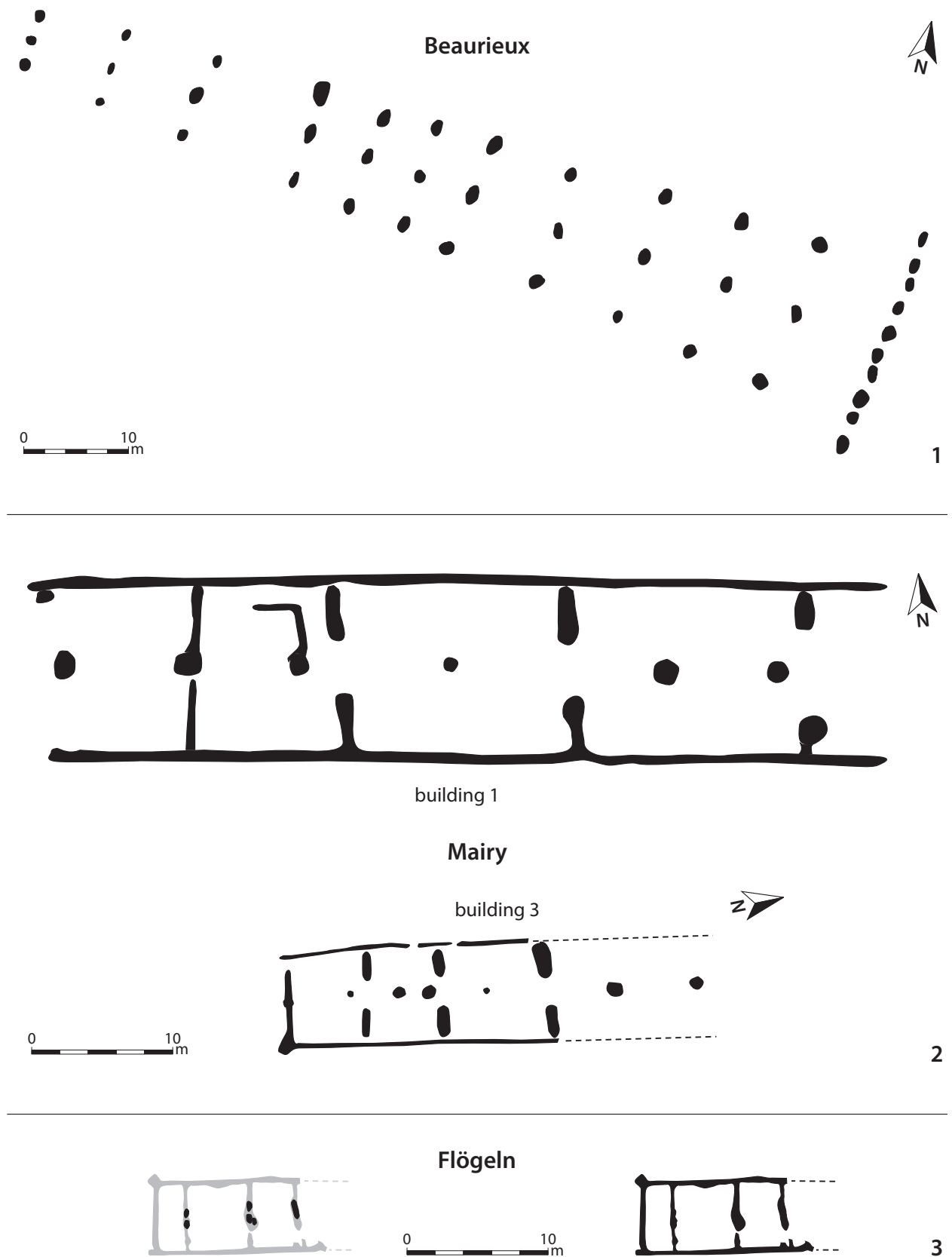


Fig. 3. 1 Cerny building of Beaurieux (after Colas et al. 2019); 2 Michelsberg buildings of Mairy (after Marolle 1989); 3 TRB buildings of Flögeln (after Assendorp 1999).

Mairy (Ardennes)

The Mairy site has yielded the remains of 18 buildings within a 30–40 ha enclosure attributed to the Michelsberg Culture (Fig. 3.2; Marolle 1989; 1998; Laurelut 1989). They are rectangular or slightly trapezoidal in plan, with a central row of large, widely spaced post holes. The walls and internal partitions are set in foundation ditches. The level of preservation is uneven, with only half of the buildings identified having yielded sufficient traces to enable their layout to be reconstructed. Five of them can be considered complete. They are between 21 and 60 m long and 9 and 13 m wide.⁸ The post holes in the central row of Building 1 (60 x 13 m) are circular or oval in shape, with a maximum dimension of 1.90 m and a depth of 1.55 m. With its surface area of 780 m² and width of 13 m, only Building 1 is likely to be attributed to the VLB category if we accept the definition proposed in the introduction. The site appears to have been occupied for several centuries, between the end of the 5th and the middle of the 4th millennium BCE. In the absence of recent dates, it is not possible to place the buildings individually within this interval. Similar plans are known for the Funnel Beaker Culture, for example at Flögeln (Niedersachsen), but for much smaller buildings (Fig. 3.3). A further indication of possible contact with the Funnel Beaker Culture is the presence at Mairy of ceramics from the Salzmünde Culture.⁹

Unfortunately, the excavation did not yield any clues as to the function of the buildings or their chronological relationships. A study of the fauna (Arbogast 1989) suggests that ceremonies of some magnitude were held on the site, with large amounts of animals, with no equivalent in the Michelsberg Culture, being slaughtered at the same time. The situation encountered at Mairy is exceptional in this culture, which has produced no other 'Mairy-type' building plan. It therefore does not reflect the 'ordinary' way of housing in this culture, which suggests that the Mairy site had a special status and perhaps an 'international' influence.

Pont-sur-Seine (Aube)

Discovered in 2009 (Desbrosse and Peltier 2010; Desbrosse *et al.* 2023; Augereau *et al.* 2021; Ravry *et al.* 2023), the Pont-sur-Seine site (PSS) has significantly changed

our understanding of the Late Neolithic in the northern half of France (Fig. 4.1). A powerful enclosure (A) with at least two monumental fortified entrances surrounds a vast area containing around thirty buildings, as well as two smaller palisaded enclosures (B and C), one of which (C) contains two 'small' enclosures with monumental entrances (D and E) that surround the two buildings (1 and 2) that will interest us in this article. A second large enclosure can be found in the immediate vicinity, in the village of La Villeneuve-au-Châtelot (Ravry *et al.* 2023). Both have been dated by dendrochronology to between 3250 and 3232 BCE. This period was previously mainly known in the region from Horgen-type ceramic facies and collective burials ("allées couvertes" and hypogea).¹⁰

"Ordinary" buildings at PSS are rectangular or trapezoidal, measuring between 3 x 10 and 5 x 20 m. House 2 (Fig. 4.2) is only slightly (15 x 5.8/9.3; 115 m²), although it differs from them in that it is surrounded by an enclosure with a monumental entrance. The palisade of the latter is made up of split trunks, whereas the palisade surrounding House 1, the one we are primarily interested in, is made up of whole trunks. Although its surface area (429 m²) and length (26 m) are no greater than those of the LBs mentioned in the introduction, its width (14/19 m) is clearly reminiscent of the VLBs of the Final Neolithic. It was built in at least two phases, initially with three parallel, slightly trapezoidal compartments, which were then joined together by a process of monumentalisation to which one can attribute the three axial rows of very large postholes and the buttress foundations that line the two long sides (Fig. 4.3). The irregularity of the whole suggests an imperfect mastery of monumental construction techniques.¹¹ The chronological relationship between Buildings 1 and 2 is not yet clear. One possible scenario is an initial phase marked by the construction of enclosure E and House 2, followed by that of the trio C + D + 1. A political trajectory marked by the transition from diffuse power (a heterarchical society) to consolidated power (a stratified society) could form the social background to this sequence. Finally, it should be noted that Pont-sur-Seine predates by several centuries the emergence of the VLBs in western France described above, and is the oldest case in Western Europe of an "individual" enclosure, *i.e.* one surrounding a single house.¹²

8 Building 1: 60 x 13 m; Build. 6: 42,0 x 9,5 m; Build. 7: 45,0 x 9,5/8,5 m; Build. 8: 22 x 9 m; Build. 9: 21,0 x 10,5 m.

9 See in Laurelut 1989, fig. 31.1.

10 For archaeological context: Cottiaux and Salanova 2014.

11 The impression of monumentalism, but also that of a technical mastery in its infancy, is reinforced by the presence, particularly in the large postholes, of sandstone

wedging stones (19 tonnes in the foundations of House 1; Desbrosse and Peltier 2010, 112).

12 This applies to the regions west of the Rhine. A more ancient case of an 'individual' enclosure is known in Germany, at the site of Kösching (Bavaria), in the Münchshöfen Culture (recent stage, c. 4000–3750 BCE, Münds-Lugauer and Losert 2023).

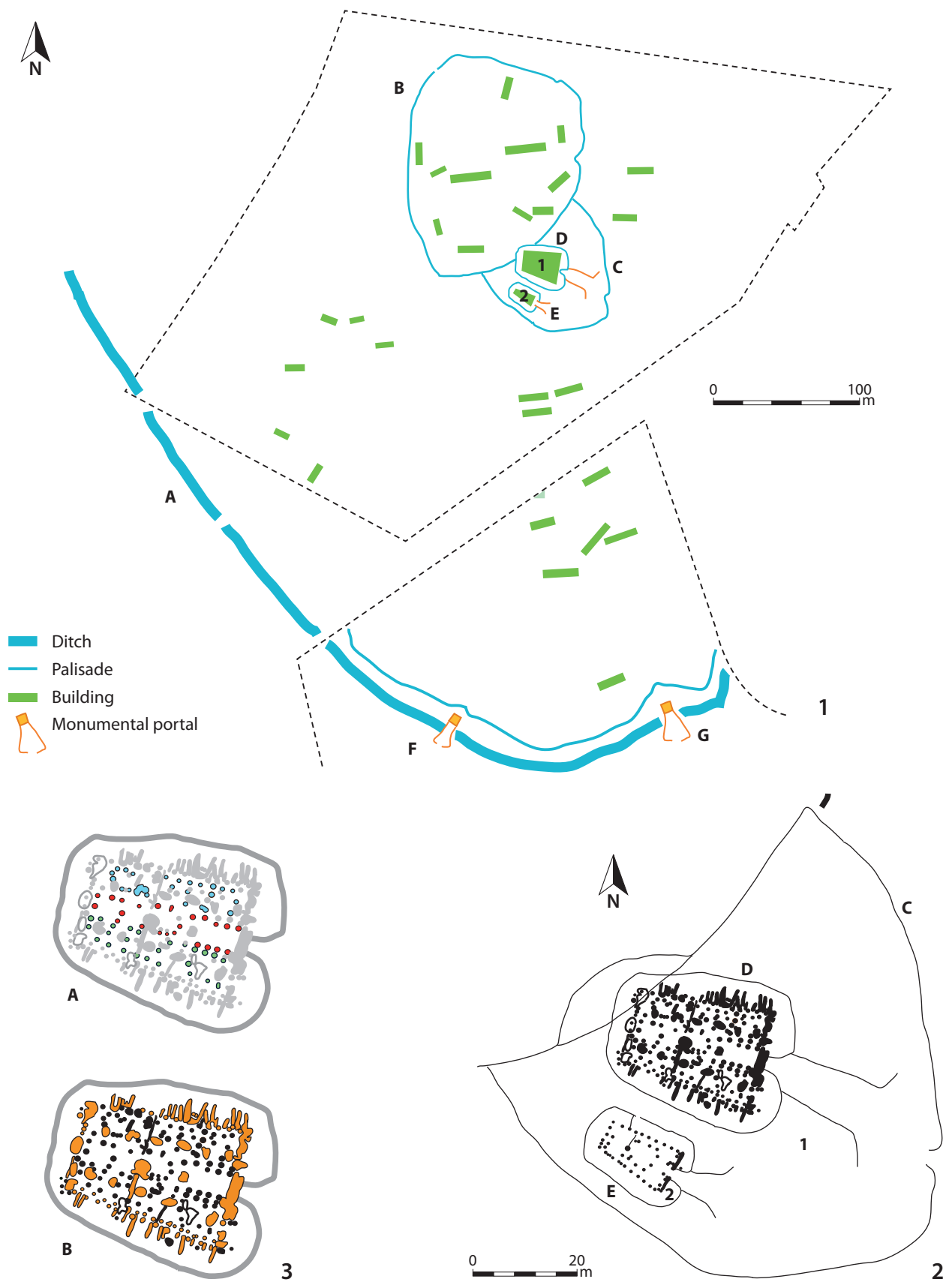


Fig. 4. Pont sur Seine (Aube). 1 General plan; 2 Plan of the two main buildings 1 and 2 (1 after Lepère 2021; 2 after Desbrosses et al. 2023).

Summary

The Carnac burial mounds (4600–4300 BCE) and the Middle Neolithic I long mounds in northern France (4800–4000 BCE) show that, apart from the building of indeterminate function at Beaurieux, the first very large monuments in western Europe were funerary monuments.¹³ The case of Mairy, with buildings of varying size within the same complex, remains fairly close to the pattern we know from the Middle Danubian Neolithic of central Europe. The dimensions of Building 1 (60x13 m) are only slightly larger than those of the largest buildings of the Linear Pottery or Rössen Cultures. Non-funerary monumentalism really begins with Building 1 at Pont-sur-Seine, which stands out for its exceptional width (19 m), the massive use of stone blocks (19 t alone for Building 1), the presence of a monumental entrance and an enclosure designed to protect a single building. These characteristics are also found in the VLBs of the 3rd millennium, although they are distinguished by their exceptional lengths, which can reach 150 m. Another point in common between Pont-sur-Seine and the western VLBs is the stark contrast, from every point of view, between the VLB and the other buildings on the site, an aspect further accentuated by the isolation of the VLBs, which are always clearly separated from the other buildings. A unitary pattern thus emerges, opening up the possibility of a filial relationship between Pont-sur-Seine (around 3250 BCE), where the techniques of monumental wooden architecture were clearly still imperfectly mastered, and the VLBs of the Western France (from 2900 BCE) and their much more sophisticated architecture.

The other thing that these two groups have in common is the spectacularly ostentatious nature of the buildings, evident in their size,¹⁴ the presence of monumental entrances and the solidity of the construction.¹⁵ Some of these characteristics can be found in the mega-structures of the very large settlement sites of the Tripolje Culture in Ukraine, which are older since they appeared around 4000 BCE, and can therefore be considered the oldest VLBs on the European continent. However, the VLBs of the Trypolje Culture are distinguished by the fact that they are close to other

buildings, integrated into a regular urban grid based on a stereotyped organisational scheme, and that several of them are found in settlements where they seem to function as political and ceremonial centres on a neighbourhood scale. The architectural differences, which we do not have the space to detail here, make it reasonable to rule out any connection between the Tripolje VLBs and the more recent French VLBs.

Two other features are worth highlighting in the case of Pont-sur-Seine and the VLBs in western France. In both cases, we are faced with structures with features that suggest that defensive concerns may have played a role in the architectural choices made: spatial isolation from other buildings, “individual” enclosures, monumental entrances (for the enclosure and/or the building), doubled or tripled external walls for the building. At Pont-sur-Seine, this impression is reinforced by the presence of two monumental “bastion”-type entrances to the main enclosure (Fig. 4.1 F and G). Another important feature is the strong contrast, from all points of view, between the VLB and, where found, the other buildings on the site.

Both at Pont-sur-Seine and in the western Final Neolithic, the lack of conservation of circulation floors and the virtual absence of pit structures other than those for building foundations make functional interpretation difficult. It was this lack of direct evidence that prompted us, in the hope of developing a relevant conceptual framework, to make a diversion into ethnology. To address the question of current or sub-current VLBs, we begin by establishing a twofold conceptual distinction: the first contrasts residential with non-residential, and is at least partially confused with a domestic/communal (dedicated to political and/or religious activities) dualism.¹⁶ The second is internal to the “residential” category, and distinguishes between buildings that house a single family and, possibly, dependants, and those that house several families on the same level of the social scale. The latter can be described as “collective” or “multi-family”. Insofar as both types have a residential purpose and the former presupposes the existence of an institutionalised social stratification, we can speak without hesitation of an “aristocratic house” for the former and a “collective house” for the latter.

13 Reminder: the Saint-Michel burial mound at Carnac (c. 4600–4400 BCE) measures 125x60x10 m) and one of the long barrows at Fleury-sur-Orne, Calvados (c. 4800–4400 BCE) reaches 372 m in length (Ghesquière and Thévenet 2021).

14 The height must also be taken into account, even if it is difficult to assess. The taller of the two buildings at Douchapt has been estimated to be at least 13.5 m high. Remember that a modern four-storey residential building is between 15 and 20 m high.

15 The large building at Douchapt required the felling of at least 400 trees (Fouéré *et al.* 2018), including a significant proportion of large trees from primary forest. In the case of Pont-sur-Seine, the impressive nature of palisade C (the one surrounding the two large buildings), made up of whole trunks, should also be highlighted, whereas its neighbour (palisade B) is made up of split trunks only.

16 Partly because of the “men’s house” type of structures, which combine the qualifications “residential” (but not “domestic”) and “community”.

FUNCTION: RECENT VLB IN PRE-STATE SOCIETIES

A diversion through the VLBs of current or sub-current non-state farmer-herder societies will enable us to begin thinking about the function of our prehistoric VLBs. There are three possible main forms of organisation for European Neolithic societies: big men societies, heterarchic societies (tribe) with no political power and, finally, stratified non-urban and non-literary societies (complex chiefdom). While the existence of big men societies remains to be demonstrated, that of the other two types is highly probable (Jeunesse 2018). From the 5th millennium onwards, sequences alternating between heterarchy and stratification even constitute a sort of leitmotif in the course of late European Prehistory (Jeunesse 2017).

The concept of VLB is not used by ethnologists, who instead use the term “longhouse” to designate large collective houses with separate “familial” apartments (Barfield 2009, 295–296). Iroquois or Dayak houses are often taken as examples of this type of architecture. Our objective is, of course, to take into account all buildings of exceptional size. Among them, we will distinguish longhouses, non-collective residential buildings and non-residential community buildings. Let us begin with a brief description of each of these types.

Longhouses with adjoining flats: the best known are found in North America (“Iroquois house”), the Amazon (Yanomami shabono; Chagnon 1968) and Borneo (Dayaks, Iban, *etc.*). They are also found in other regions of South-East Asia¹⁷ and in New Guinea. In Borneo, they can be over 300 m long, house more than 1,000 people and represent the only building in a village. In America and New Guinea, they are lightweight (built from small-diameter woods) and ephemeral structures, typical of communities practising shifting agriculture and moving every few years. This does not prevent them from reaching quite spectacular dimensions. Among the Kaluli of Papua New Guinea, they can house more than 100 people and are up to fifteen metres wide (Loupis 1983). Some of the longhouses of Borneo are more solidly built and more durable, particularly when they are built by sedentary communities growing irrigated rice.¹⁸ They are often built from

ordinary materials and set on relatively gracile stilts.¹⁹ With some notable exceptions,²⁰ these houses are found in politically egalitarian societies.

Large non-residential community buildings: these are relatively rare in pre-state societies. The exception often mentioned is the large ceremonial buildings of Papua New Guinea, in particular those of the Sepik Basin and the Gulf of Papua area.²¹ The Iatmul are one of the most extensively studied Sepik groups (Coiffier 1992). Their ceremonial buildings are clearly distinct from the small domestic structures and can be up to 15 m high and 60 m long. Meticulously built, they are set in a square in the centre of the village and are richly decorated. They were the heart of the community's social, political and ritual life, and were only visited by men. Among the Abelam, ceremonial buildings up to 25 m high, similar to those of the Iatmul, are used by the spirits to visit their descendants and house the group's sacred objects (Häuser-Schäublin 2015).

Large non-collective residential buildings: they house the main family of an aristocratic lineage and its dependents. To give just three examples, they can be found in groups on the North West Coast of North America (NWC) and on the Indonesian islands of Nias and Sumba. The large rectangular houses of the NWC were up to 18 m wide and over 100 m long.²² They could house more than 300 people (Ames 1996) in a series of flats arranged according to a strict hierarchical principle, with the head of the lineage's family in the centre and the others on the outskirts. Their construction is meticulous, with plank walls and majestic frameworks. Their often spectacular decoration (completed by the so-called “sculpted totem-poles” erected in front of the house) reflects the wealth and prestige of the owner's household's lineage. The largest houses belonged to the most renowned noble families and could be occupied continuously for centuries. All the houses of a village are built side by side, and even the largest are never spatially separated from the others, their alignment facilitating comparison and confrontation. The very largest are occupied by noble lineages who owe their privileged position to prestige and wealth.

17 Vietnam and Cambodia in part. (Winzeler 2011, 113 *et seq.*)

18 A Ngaju house (Kalimantan) occupied for more than 80 years was observed in the middle of the 20th century by Douglas Miles (1964).

19 For the Rungus of the province of Sabah (malaysian part of Borneo), Azizi Bahaiddin *et al.* describe longhouses “constructed entirely of traditional materials utilising small split timbers lashed with rattan for the frame, palm fronds for the thatched roof, split bamboo for the floor and tree bark of hewn wood for the compartment walls”

which length used to be more than 200 m (Bahaiddin *et al.* 2015).

20 In Borneo, in societies engaged in the process of stratification, longhouses are found where the chief's flat is larger and has special decorations (Sellato 1987; Waterson 1997, 147–149).

21 For the Gulf of Papua (Waterson 1997, 6).

22 Ames reports of enormous houses by the Salish: 192 x 18 m and 160 x 18 m and by the Chinook: 144 x 9 m and 110 x 9 m (Ames 1996, 139 table 9.3).

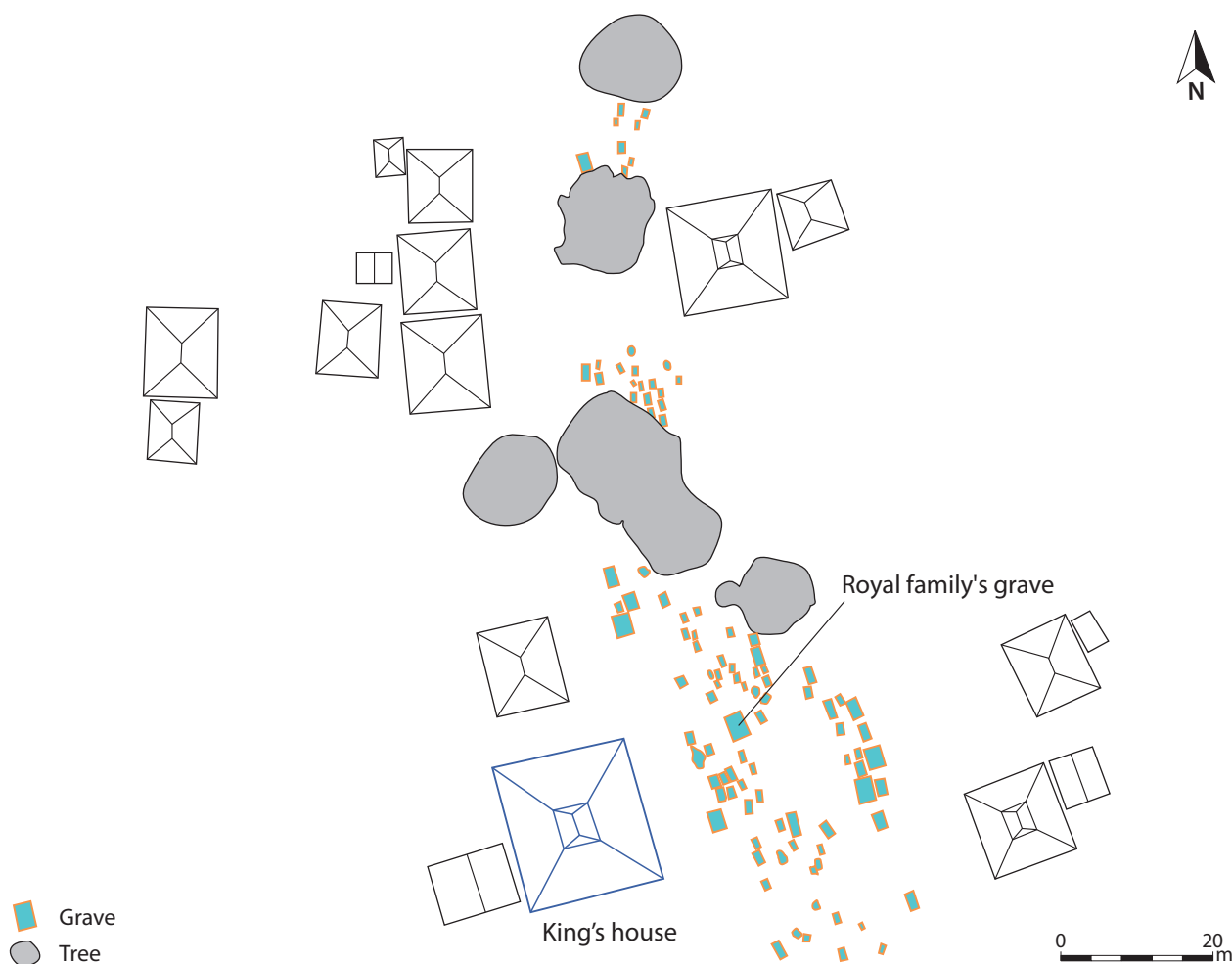


Fig. 5. Northern part of the village of Manuakalada, capital of the Mamboro stratified “domain” (Sumba Island, Indonesia) (2019, based on a drone photo by Fabrice Monna).

However, their status was not institutionalised as in stratified societies. A comparable socio-political system, for which the notion of rank society is sometimes used, exists on the island of Nias in western Indonesia. Like for the NWC, the very large houses are also inserted into the village fabric but the emphasis is, in this case, placed on height rather than length. The famous house of the village chief of Bawomataluo, built around the middle of the 19th century CE, is 24m high, 30m long and 9.10m wide (Viaro 1984).

In Sumba, only the stratified societies in the east had very large houses; up to 400 m² compared with 100 m² or less for the houses in the egalitarian villages in the west (Fig. 5). They were occupied by the families of the royal clan, which exercised coercive political power over its territory. Their layout differs little from that of the other houses, the fundamental distinguishing feature clearly being their extraordinary size. The power of the royal clan is also displayed in monumental megalithic tombs. Whether in North West Coast,

Nias or Sumba, the very large buildings are all residential structures and there is nothing comparable there to the ceremonial buildings in Papua New Guinea.

A quick survey of the ethnological literature confirms that the case of Papuan ceremonial buildings is an exception and that, in pre-state societies, the vast majority of LBs or VLBs have a residential function. The fundamental distinction is between collective houses with adjoining flats and “individual” houses dominated by a family or lineage. The former are found in egalitarian societies of itinerant horticulturalists or in groups that have only recently abandoned this way of life. The combination of monumentalism and light, non-ostentatious architecture defines them quite well. The latter appear either in stratified societies (East-Sumba), or in egalitarian societies based on rank (Nias, NWC). In a context of harsh social competition, they are characterised, among other things, by the massiveness of the architecture and the desire to be ostentatious.

CONCLUSIONS

Even if the paucity of contextual data means that we must be cautious, the hypothesis of a non-residential community building cannot be rejected out of hand for Beaurieux (radical discontinuity with contemporary domestic structures) and Mairy (uniqueness and inter-regional vocation of the site within the Michelsberg Culture). For Pont-sur-Seine and the Late Neolithic VLBs, whose strong similarities have been highlighted, the domestic function seems to us to be the most reasonable option, with the two possibilities of the collective house or the aristocratic house. The main features of this corpus argue overwhelmingly in favour of the latter: the massive architecture, the care taken with the construction, the absence of any evidence of partitioning into flats, the palisaded enclosure, the monumental entrance, and the stark contrast with other houses in the same settlement all clearly tip the balance in this direction. As far as the socio-political context is concerned, the isolation and centrality of the VLBs, which contrasts with the integration into the village fabric observed at Nias and in the North West Coast, where the largest houses appear more as *primus inter pares* than as true residences of some “supreme chiefs”, seem to us to be strong arguments in favour of stratified societies. On the other hand, the *primus inter pares* system of ranked societies seems to us to be applicable to the situation observed in the Early and Middle Danubian Neolithic (LBK and *Mittelneolithikum*), where the large houses are always well integrated into the village fabric, and could also be applied to the case of Mairy.

In our view, it is in stratified societies that more parallels should be sought for Late and Final Neolithic French VLBs. There are certainly some remarkable examples, notably in North America (Mississippian Culture) and in the Pacific islands, but the corresponding data are more often than not archaeological

data reflecting ancient realities of disappeared groups, which places us, from an epistemological point of view, in the same situation as for the study of European prehistoric buildings.

Finally, the case of Pont-sur-Seine deserves our attention because it illustrates the fact that the definition of the concept of VLB cannot be based solely on the length and surface area of buildings, as we suggested in the introduction by referring to the 500 m² threshold for buildings in prehistoric Europe. The concept of VLB is a relative one and depends on local contextual data. We should therefore avoid talking about VLB without specifying which cultural and chronological block we are talking about. In prehistoric Europe, the care taken in the construction, a width greater than 13 m, the presence of defensive structures directly associated with the building and a marked contrast with other buildings in the same settlement are at least as important as the surface area of the building. From this point of view, the concept should therefore be reserved, in its current state, for the Late Neolithic of the Upper Seine Basin (Pont-sur-Seine) and the Late Neolithic VLBs of western France. The mega-structures of the mega-sites of the Tripolje Culture meet only part of these criteria and merit further discussion.

If the VLBs in the two ‘French’ corpora were indeed produced by stratified societies, we will have to admit that the construction of monumental tombs and exceptional funerary furnishings (Carnacian burial mounds, Varna, Maikop) are not the only way of expressing the power of dominant lineages. From this point of view, the “princely palace” can be seen as the equivalent of the “princely tomb”. With our two periods with VLBs we can therefore, albeit with due caution, add at least two episodes to the several non-egalitarian thrusts that generated stratified societies in Europe’s late prehistory (Jeunesse 2017).

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Detecting Prehistorical Settlements and Husbandry Systems and Their Pollution Impact on Lake Water Quality by Using Macroscopic Charcoal and Hydrophyte Remains from the Former Lake of Bruszczewo (Greater Poland)

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KEYWORDS: prehistorical lake eutrophication, water plants, charcoal, agricultural fertilisation, Central Europe

Abstract

Evidence for prehistorical lake water pollution and trophic level changes is scarce for areas where heavy human settlement activities are evidenced by archaeological means. Here we present palaeoecological results from the prehistorical oxbow lake of Bruszczewo, Poland. Macroscopic charcoal pieces and macrofossil remains of aquatic plants (such as those from the water lilies — *Nuphar* and *Nymphaea* — or broad-leaved pondweed — *Potamogeton natans*) revealed strong prehistorical lake water pollution since the Late Neolithic (4050 cal BP, i.e. 2100 BCE) and especially during the presence of an Early Bronze Age (2000–1650 BCE) lake-shore village. These results suggest high nutrient input (nitrogen, phosphates) to the lake due to agricultural run-off and/or faeces input, possibly in relation to field manuring. The recovery of the lake ecosystems and lake water quality towards mesotrophic conditions after 1650 BCE occurred within a few centuries only, following the abandonment of the Early Bronze Age settlement of Bruszczewo. This is evidenced by the subsequent growth of hydrophytes needing mesotrophic water conditions (spiny naiad — *Najas marina* ssp. *intermedia*)

during the Late Bronze Age (1150 BCE). Furthermore, the lake turned to oligotrophic (or slightly mesotrophic) conditions around 800 BCE, as revealed by the presence of slender naiad (*Najas flexilis*) after the abandonment of a Late Bronze Age settlement on the littorals of the former lake of Bruszczewo. This suggests a high level of resilience to eutrophication and recovery of prehistoric lake ecosystems, which is also of interest for nature conservation and restoration of lake ecosystems today. In addition, high amounts of macroscopic charcoal in the naturally grown lake sediments do highly correlate to the known archaeological settlement phases around the lake, and in turn allow us to hypothesise about the presence of additional settlements on the lakeside for periods where no archaeological finds are known thus far. This is, for example, the case for very high macroscopic charcoal amounts present in the lake sediments for the end of the Middle Bronze Age and the early Late Bronze Age (1370–1250 BCE), likely pointing at a large prehistorical settlement that archaeologists should search for in the future.

Zusammenfassung

Der Nachweis von prähistorischer Seewasserverschmutzung und von Änderungen in See-Trophiezuständen gelingt relativ selten in Gebieten wo starker menschlicher Einfluss durch archäologische Forschungen nachgewiesen wird. Hier stellen wir paläoökologische Ergebnisse aus dem prähistorischen Altwassersee von Bruszczewo, Polen, vor. Makroskopisch große Holzkohlestücke und Reste von Wasserpflanzen (wie die von Seerosengewächsen — *Nuphar* und *Nymphaea* — oder von Laichkräutern — *Potamogeton natans*) offenbarten starke prähistorische Seewasserverschmutzungen seit dem Endneo-

lithikum (4050 cal BP, d.h. 2100 v. Chr.) und speziell auch während der Existenz einer frühbronzezeitlichen Seeufersiedlung (2000–1650 v. Chr.). Die erhobenen Resultate weisen auf einen hohen Nährstoffeintrag (Stickstoff, Phosphat) in den Altwassersee hin, und dies auf Grund von landwirtschaftlicher Erosion und/oder von Exkrementen-Eintrag, möglicherweise im Zusammenhang mit Felddüngung. Andererseits dauerte die Erholung des See-Ökosystems und der Wasserqualität nach Aufgabe der frühbronzezeitlichen Siedlung um 1650 v. Chr. hin zu mesotrophen Bedingungen, nur wenige Jahrhunderte.

*Dieser Nachweis gelang insbesondere durch das nachfolgende Wachstum von Wasserpflanzen wie dem Grossen Nixenkraut — *Najas marina* ssp. *intermedia* während der Spätbronzezeit (1150 v. Chr.). Zudem wandelte sich der See um 800 v. Chr. zu einem oligotrophen (bis leicht mesotrophen) Gewässer, wie durch das Vorhandensein des Biegsamen Nixenkrauts (*Najas flexilis*) nach der Aufgabe der spätbronzezeitlichen Seeufersiedlung nachgewiesen werden konnte. Dies weist auf eine hohe Anpassungsfähigkeit und Erholungsfähigkeit von prähistorischen Seeökosystemen gegenüber Eutrophierung hin, was auch für heutige Naturschutzbestrebungen und See-Renaturierungen von Belang ist. Interessanterweise korrelieren die hohen makroskopischen Holzkohlemengen*

in den natürlich abgelagerten Seesedimenten hoch signifikant mit den archäologisch bekannten Siedlungsphasen rund um den Altarmsee von Bruszczewo, was uns zur Hypothese führt, dass noch weitere, bisher archäologisch unentdeckte, prähistorische Siedlungen rund um den See vorhanden sein dürften. Dies ist zum Beispiel der Fall für die sehr hohen Holzkohlewerte, die sich zum Ende der Mittleren Bronzezeit und in der frühen Spätbronzezeit (1370–1250 v. Chr.) in den Seesedimenten finden, und die mit großer Wahrscheinlichkeit auf eine große prähistorische Siedlung hinweisen, die von Archäologinnen und Archäologen in naher Zukunft gesucht werden sollte.

INTRODUCTION

Comparing archaeological results on prehistorical dwellings in Poland with palaeoecological reconstructions for the time period of such settlements highly adds on our understanding of past subsistence systems, their impact on ecosystems, and according landscape evolution (Ralska-Jasiewiczowa and Latalowa 1996; Milecka 2000; Ralska-Jasiewiczowa 2004; Kneisel *et al.* 2008). However, classical palaeoecological reconstructions do mainly use palynological methods in order to achieve such goals. Pollen and other microfossils (so called “Non-Pollen-Palynomorphs”) such as spores from coprophilous fungi or cysts from green algae may thereby help to elucidate former trophy levels of lakes, and the impact of daily life or agricultural activities of adjacent prehistorical societies and their livestock on terrestrial grounds (van Geel 2001; Haas and Wahlmüller 2004; 2010; Kneisel *et al.* 2008).

For the archaeological site of Bruszczewo, dated to the Early Bronze Age (Únětice Culture c. 2000–1650 BCE), and again settled during the Late Bronze Age (Lusatian Culture, c. 1000–800 BCE), several archaeological (Müller and Czebreszuk 2003; Czebreszuk and Müller 2004; 2015; Czebreszuk *et al.* 2015a, b) and palynological as well as palaeoethnobotanical studies were published within the last 20 years (Haas and Wahlmüller 2004; 2010; Karg *et al.* 2004; Makowiecki 2004; Diers 2007; Wazny 2010; Kroll 2010; Niebieszczański *et al.* 2023), most of them realised and published thanks to a large German-Polish research programme started in 1999 and co-lead by Johannes Müller (Universities of Bamberg and Kiel), and to whom we dedicate this publication for his 65th birthday on November 29, 2025. Most of the interpretation and data discussion presented here were performed by biology students in 2010 during a master student lecture at the University of Innsbruck dealing with “Scientific writing and publishing”.

The above mentioned palynological and palaeoethnobotanical offsite and onsite studies (Haas and Wahlmüller 2004; 2010; Niebieszczański *et al.* 2023) revealed a huge regional agricultural impact at the time of the Early Bronze Age for the mentioned region, and that the oxbow lake of the Samica river adjacent to the settlement area of Bruszczewo (Wójcicki 2006) was regularly impacted by agricultural runoff and possible input of waste and faeces to the lake waters, especially given the microscopic non-pollen palynomorphs finds (Haas and Wahlmüller 2004; 2010; Niebieszczański *et al.* 2023). However, this human and livestock action and its local impact on the lakeside macrophyte, hydrophyte, and/or faunal communities remained nearly unstudied so far.

A first macrofossil study on the sediments of lake Bruszczewo was performed in 2008, and presented at the XVIII INQUA Congress in Bern in 2011 (Haas 2012). This study was followed by another palaeoecological study on the Bruszczewo area by Jakub Niebieszczański *et al.* (2023) using relatively small sediment samples (2 cc) and selected time intervals, and which revealed general changes towards terrestrialisation of the prehistorical to historical oxbow lake of Bruszczewo.

Here we present the above mentioned, detailed and high-resolution macrofossil study performed in 2008 on 78 sediment samples (between 378.5 and 56.5 cm core depth, and a mean resolution of c. 4 cm) for the above mentioned Bruszczewo lake stratigraphy (BRU-16/5.5), also as incentive for comparable interdisciplinary lake sediment studies between palaeoecologists and archaeologists. Such macrofossil research on lake and peat sediments is of relatively high time demand when using sediment samples mostly larger than 5 cc and small sieve size fractions (>250 µm), but leads at detailed chronological reconstruction of past ecosystem changes.

So, here follows the reconstruction of the Bruszcze-wo oxbow lake ecosystem changes since the Late Neolithic at 4325 cal BP (2375 BCE, 2 sigma) by using plant and faunal macrofossil analyses, and the quantification of according remains ($>250\text{ }\mu\text{m}$). Our hypothesis is, that heavy eutrophication of the lake water would result in a local within-lake environmental pollution, impacting on the composition of the local flora and fauna, and subsequently resulting in eventually (near-)

toxic, undrinkable water conditions for humans and their livestock at the time. Also, our macrofossil studies aimed to check, if and how long such an oxbow lake ecosystem may have taken to self-restore to nutrient-poor (oligotrophic) conditions, in view of general lake quality restoration activities by nature conservation management authorities of Poland and Central Europe today.

MATERIALS AND METHODS

Research Location

The Bronze Age settlement of Bruszcze-wo (69–74 m a.s.l.; 50°00'46.49''N, 16°35'09.57''E) lies on a landscape spur in the Obra river valley system in the commune of Śmigiel (County of Kościan) about 60 km south of Poznań in Greater Poland, between small hills and terraces, today (Fig. 1). The area is known to be of high agricultural interest since the Neolithic period due to the

ideal sandy and fertile soils (Wasylikowa 2004). During the Bronze Age the settlement was lying on the littoral of a 33-ha large oxbow lake (Czebreszuk and Müller 2004). The final terrestrialisation of this oxbow lake happened about several hundred years after the Bronze Age settlement, between ca. 790 and 200 BCE dependant on the lake area studied (Haas and Wahlmüller 2010, Niebieszczański *et al.* 2023).

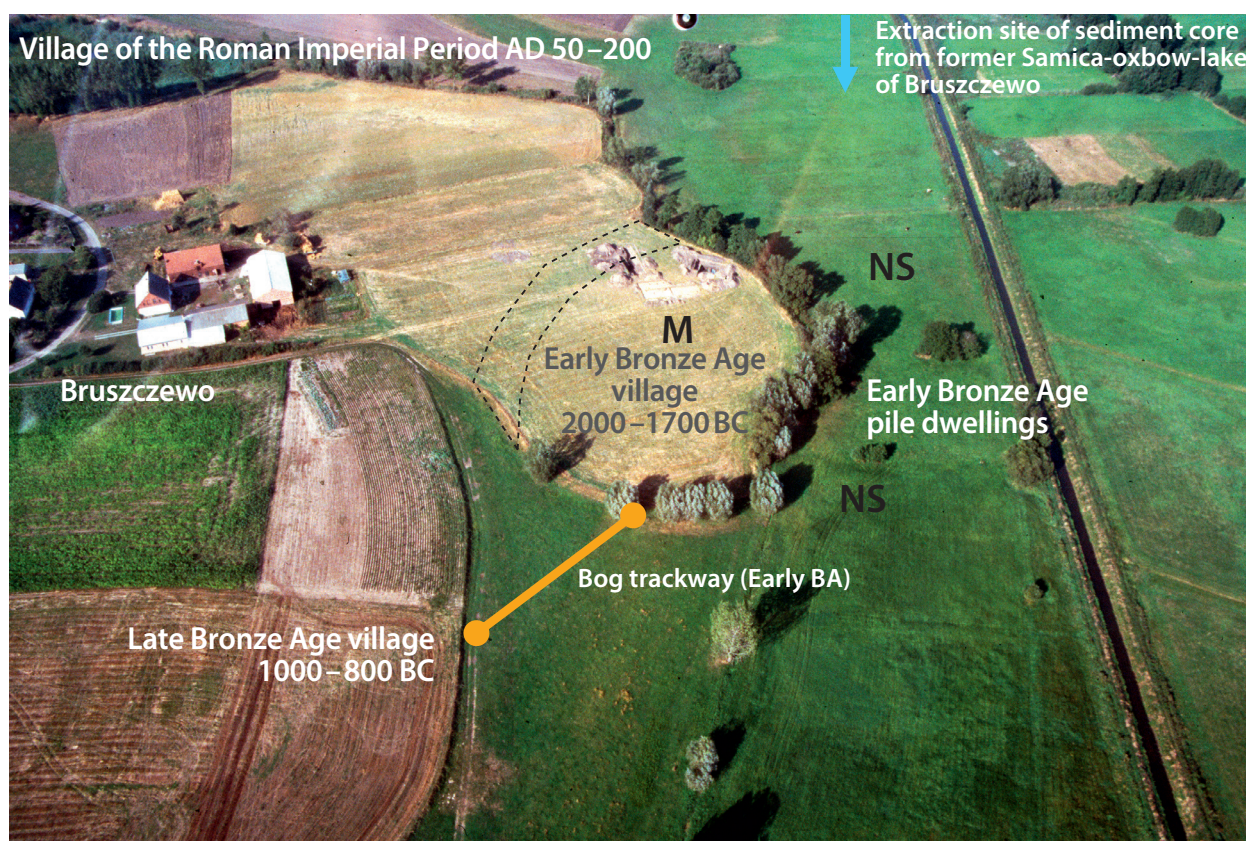


Fig. 1: Overview on the strategic position of the Bruszcze-wo settlement area with the major lake-side villages from the Early Bronze Age, Late Bronze Age and Roman Imperial Period. The coring location for the Bruszcze-wo stratigraphy extracted from the former Bruszcze-wo lake (BRU-16/5.5, 69.10 m a.s.l.) and studied for palynological and macrofossil content is shown by a blue arrow (Photo: Jacek Nowakowski, compilation by Jean Nicolas Haas).

Table 1: Radiocarbon dates performed on remains from terrestrial plants from the sediment stratigraphy extracted from the former Bruszczewo lake (BRU-16/5.5) and measured at the radiocarbon laboratories of Poznań (POZ) and Kiel (KIA). The age from a depth of 160 cm (light italic) was rejected. Calibration was done following Maarten Blaauw (2010) and using the IntCal20 calibration curve (Reimer et al. 2020). Abbreviations: *AlGlu*=*Alnus glutinosa*, *S*=Seed, *SL*=Substantia lignosa.

Sample name and Lab.-no.	Depth (cm) / Material	Radiocarbon age uncalibrated	Modelled calibrated age / 2sigma (see Appendix 1)
BRU 16/5.5 / POZ-7831	80 / SL indet. (twig)	2020 ± 50 BP	1956 cal BP (6 BC)
BRU 16/5.5 / POZ-7832	131 / AlGlu S + 1 <i>Alnus</i> -SL	2390 ± 50 BP	2474 cal BP (524 BC)
<i>BRU 16/5.5 / POZ-7910</i>	<i>160 / Alnus twig-Nodium (cf)</i>	<i>(2885 ± 35 BP)</i>	<i>rejected</i>
BRU 16/5.5 / POZ-7911	211 / Bark piece indet.	2885 ± 35 BP	3022 cal BP (1072 BC)
BRU 16/5.5 / POZ-7913	294 / Charcoal indet.	3560 ± 35 BP	3848 cal BP (1898 BC)
BRU 16/5.5 / KIA29413	345 / 4 Wood particles	3764 ± 55 BP	4137 cal BP (2187 BC)

Oxbow lake sediment coring

A 7 m long sediment profile (BRU-16/5.5) was cored in the centre of the former oxbow-lake with a so-called “Russian peat corer” in 2005, about 150 m NE of the former Early Bronze Age settlement area, in order to perform several palaeoecological studies. The pollen and non-pollen palynomorphs of the uppermost 395 cm sediments were studied and published by Jean Nicolas Haas and Notburga Wahlmüller (2010) and represent the sedimentation of the last 4350 years according to the age-depth model based on five radiocarbon dates (see Table 1 and Fig. 2; Haas and Wahlmüller 2010 for details; Table 2 for an overview on the chronology).

Table 2: Sediment description for the sediment stratigraphy extracted from the former Bruszczewo lake (BRU-16/5.5; land surface at 69.10 m a.s.l.).

Bruszczewo 16 / 5.5 Sediments		
Depth	Sediment	Chronology
0–25 cm	Agricultural soil, not sampled	Recent to High Medieval
25–96 cm	Peat	2118–577 cal BP (169 BC – AD 1373, Iron Age to High Medieval)
96–395 cm	Calcareous Lake Gyttja (with molluscs)	4420–2118 cal BP (2470–169 BC (Neolithic to Iron Age)

Sediment sampling and laboratory methods

Sediment sampling for macrofossil analyses was performed at the Department of Botany of the University of Innsbruck (Austria). A total of 78 macrofossil samples were extracted from the 395 cm long sediment core at regular sampling intervals (between 378.5 and 56.5 cm), always representing a sediment thickness of one cm,

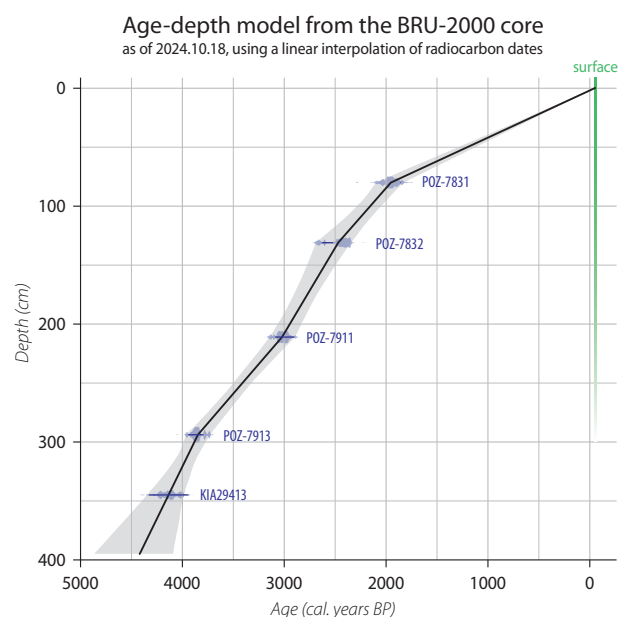


Fig. 2: Age-Depth model (performed in “clam” (Blaauw 2010; version 2.4.0) available in R (R Core Team 2021; version 4.1.2) and linear interpolation of the radiocarbon dates (see tabel 1 for details) from the former Bruszczewo lake stratigraphy (BRU-16/5.5) and measured at the radiocarbon laboratories of Poznań (POZ) and Kiel (KIA). Calibration was done following Maarten Blaauw (2010) using the IntCal20 calibration curve (Reimer et al. 2020) (Graphic: Benjamin Dietre).

i.e. one cm of sediment deposition, each. All samples were weighted before further treatment, and were sieved with running water through a pile of metal sieves with mesh sizes of 2.00, 1.00, 0.50 and 0.25 mm thereafter. All recognizable macrofossils were picked out with a forceps under a binocular, transferred to small flacons containing distilled water, determined to species, genus or family level by the help of the macrofossil reference collection of the Department of Botany (University of Innsbruck, Austria) as well as with reference literature (Cappers et al. 2006), and quantified

(and where any determined macrofossil was counted as such). Thereafter all macrofossil finds were normalized to a common weight of 7 g, in order to make the macrofossil content comparable and interpretable. The results of the macrofossil analyses are presented within

the computer software TILIA (Grimm 2011) including a CONISS-statistical cluster analysis (Table 3). All plant and animal remains, as well as the minerogenic compounds are summarized further down, and do show all finds found in all four sieve fractions mentioned above.

Table 3: Result of the statistical CONISS clustering in TILIA computer software (Grimm 2011) resulting in 13 Local Macrofossil Assemblage Zones (LMAZ) for the former Bruszczewo lake stratigraphy (BRU-16/5.5; land surface at 69.10 m a.s.l.) and their time-ly delimitations ("line") in years cal BP (Before Present (BP) = AD 1950) and in relation to the sediment depth (in cm).

LMAZ	Age (cal. years BP)			Depth (cm)		
	Bottom	Top	Line	Bottom	Top	Line
1	4326,4	4258,4	4258,4	378,5	366,5	366,5
2	4258,4	4016,2	4016,2	366,5	323,8	323,8
3	4016,2	3792,6	3792,6	323,8	289,0	289,0
4	3792,6	3424,9	3424,9	289,0	251,5	251,5
5	3424,9	3161,2	3161,2	251,5	225,0	225,0
6	3161,2	3031,8	3031,8	225,0	212,0	212,0
7	3031,8	2857,5	2857,5	212,0	187,0	187,0
8	2857,5	2789,0	2789,0	187,0	177,0	177,0
9	2789,0	2535,5	2535,5	177,0	140,0	140,0
10	2535,5	2230,3	2230,3	140,0	107,0	107,0
11	2230,3	2067,9	2067,9	107,0	91,0	91,0
12	2067,9	1429,7	1429,7	91,0	59,0	59,0
13	1429,7	1366,9	-	59,0	56,5	-

RESULTS

The results of the macrofossil analyses on the lake profile BRU-16/5.5 are shown on figure 3. A CONISS cluster analysis resulted in 13 macrofossil assemblage zones (LMAZ; Table 3), which can be described as follows (ages rounded to nearest five years; see Appendix 1 for details).

LMAZ-1:

378.5–366.5 cm depth, calcareous gyttja, 4325–4260 cal BP (2375–2310 BCE), Neolithic.

The lowermost LMAZ related to three macrofossil samples is characterised by some few macroscopic charcoal particles (>250 µm), as well as some few undetermined wood (*Substantia lignosa*), as well as some few fish (*Pisces*) and Chitin remains.

LMAZ-2:

366.5–323.8 cm depth, calcareous gyttja, 4260–4015 cal BP (2310–2065 BCE), Neolithic – Early Bronze Age. This LMAZ was statistically defined by seven studied sediment samples, and is characterised by some birch (*Betula*) and alder (*Alnus*) remains, as well as some few macroscopic charcoal particles. At the end of this zone,

around 4050 cal BP, some seeds from the yellow water lily (*Nuphar*) reveal a first eutrophication phase of the Bruszczewo lake, as this plant species is dependent on mesotrophic to eutrophic water conditions in order to produce fruits and seeds.

LMAZ-3:

323.8–289 cm depth, calcareous gyttja, 4015–3795 cal BP (2065–1845 BCE), Early Bronze Age.

This LMAZ was statistically defined by six studied sediment samples, and is characterised by relatively high amounts of pine (*Pinus*) and alder remains, as well as high charcoal amounts. Remains from cultural (*Cerealia*) and eatable crop weeds (*Chenopodium* cf. *album*) do hint at nearby agricultural fields surrounding the lake. Yellow water lily (*Nuphar*) seeds continue to be present in several samples, together with fruits of broad-leaved pondweed (*Potamogeton natans*), again a good indicator for highly eutrophic water conditions. Hemp agrimony (*Eupatorium cannabinum*) was growing on the wet littorals of the lake or on wet meadows, as revealed by some seed finds, and do point to high nitrogen content of the according soils around the lake.

Some finds of gastropod shells and fish remains do represent the internal fauna of the lake.

LMAZ-4:

289–250 cm depth, calcareous gyttja, 3795–3425 cal BP (1845–1475 BCE), Early to Middle Bronze Age.

This LMAZ was statistically defined by five studied sediment samples, and is characterised by some seeds of elderberry (*Sambucus*) and some charcoal particles. *Nuphar* seeds remain abundant, as well as seeds of (white) water lilies (*Nymphaea*), again a good indicator for a high nutrient content of the lake water. Some seeds of marsh cinquefoil (*Potentilla palustris*) hint at some peatlands around the lake. The lake-internal fauna remains unchanged (presence of some gastropod shells and fish remains).

LMAZ-5:

250–225 cm depth, calcareous gyttja, 3425–3160 cal BP (1475–1210 BCE), Late Bronze Age.

This LMAZ was statistically defined by eleven studied sediment samples, and is characterised by some few finds of pine, alder and elderberry. However, this zone is now characterised by very high amounts of macroscopic charcoal, likely related to nearby settlement activities. *Nuphar* and *Nymphaea* remain present, as well as high amounts of gastropods (including shales of *Anodonta cygnea*). Remains of caddisflies (Trichoptera) and Chironomids (Chironomidae) add to the fish fauna of the lake.

LMAZ-6:

225–212 cm depth, calcareous gyttja, 3160–3030 cal BP (1210–1080 BCE), Late Bronze Age.

This LMAZ was statistically defined by eight studied sediment samples, and is characterised by a high number of alder fruit finds, as well as a reduced number of charcoal. Some Cerealia finds reveal agricultural fields around the lake, or possibly the processing of cereal products within lake-shore settlement areas. *Nuphar* and *Nymphaea* remain present, however, first occurrences of spiny naiad (*Najas marina* ssp. *intermedia*) do hint at trophy changes within the lake, pointing towards more mesotrophic lake water conditions.

LMAZ-7:

212–187 cm depth, calcareous gyttja, 3030–2860 cal BP (1080–910 BCE), Late Bronze Age.

This LMAZ was statistically defined by five studied sediment samples, and is characterised by high amounts of pine and alder remains. Cerealia finds are abundant, especially in one sediment sample of this zone. Spiny naiad remains are present together with *Nuphar* and *Nymphaea*. Some alderflies (*Sialis*) and bryozoans (*Cristatella mucedo*) add to the fauna of the lake.

LMAZ-8:

187–177 cm depth, calcareous gyttja, 2860–2790 cal BP (910–840 BCE), Late Bronze Age.

This LMAZ was statistically defined by four studied sediment samples, and is characterised for the second half of this zone by high macroscopic charcoal amounts. Spiny naiad continues to grow in the lake, however, first charophyte (Characeae) oospores are also present. The fauna seems to remain rather unchanged compared to the LMAZ-7.

LMAZ-9:

177–140 cm depth, calcareous gyttja, 2790–2535 cal BP (840–585 BCE), Late Bronze Age to Iron Age.

This LMAZ was statistically defined by eleven studied sediment samples, and is again characterised by high pine and alder finds, together with some elderberry seeds. Macroscopic charcoal particles are present, however in small amounts only. Charophyte oospores and seeds of spiny naiad continue to be present, when the sudden first occurrence of seeds of slender naiads (*Najas flexilis*) is recorded, pointing to a change towards oligotrophic water conditions around 2750 cal BP (800 BCE), probably in relation of the abandonment of the agricultural area and a reduction in agricultural runoff at the end of the Late Bronze Age. As *Najas flexilis* is only growing in water depths of less than four meters, this points at shallow water conditions at the coring site. Interestingly some *Acroloxus lacustris* snail shells were present, pointing at a rich in-lake water plant diversity in — again — shallow and eutrophic waters.

LMAZ-10:

140–107 cm depth, calcareous gyttja, 2535–2230 cal BP (585–280 BCE), Late Iron Age.

This LMAZ was statistically defined by seven studied sediment samples, and is characterised by some charcoal particles, as well as some chenopod seeds. Charophytes and spiny naiads remain present throughout this zone, but *Nuphar* finds do disappear at the beginning of this zone, as well as *Nymphaea* finds some time later, pointing at only slightly mesotrophic to oligotrophic water conditions in shallow waters, not ideal for the latter water plant species.

LMAZ-11:

107–91 cm depth, calcareous gyttja/peat, 2230–2070 cal BP (280–120 BCE), Late Iron Age.

This LMAZ was statistically defined by three studied sediment samples, and is characterised by again some pine and alder remains, as well as some macroscopic charcoal around 2050 cal BP. Water lilies remains are absent during this zone, whereas remains of slender and spiny naiads continue to be abundantly present.

[illegible]

Fig. 3. Macrofossil Diagram for all taxa from the former Bruszczewo lake stratigraphy (BRU-16/5.S). Taxa numbers normalised for 7g of sediment per sediment depth. Statistical

LMAZ-12:

91–59 cm depth, peat, 2070–1430 cal BP (120 BCE–520 CE), Late Iron Age, Roman Imperial Period to Early Medieval.

This LMAZ was statistically defined by three studied sediment samples, only, and is characterised by some alder finds. At the beginning of this zone some last remains of slender and spiny naiad, from fishes, sponges (Porifera), as well as eggs from the parasitic great tailed leech (*Piscicola geometra*, parasitic on fish) do pinpoint at the final shallow water conditions, as well as

the subsequent terrestrialisation processes towards a peat-forming bog environment.

LMAZ-13:

59–56,5 cm depth, peat, 1430–1370 cal BP (520–580 CE), Early Medieval.

Finally, this LMAZ was statistically defined by two studied sediment samples, and is characterised by moss remains (Bryophytes), as well as abundant finds of sedges (Cyperaceae) and roots, related to the plants growing and forming the peat sediments.

DISCUSSION

Macroscopic charcoal particles (>250 µm) were present throughout the sediment stratigraphy of the former Lake Bruszczewo, except for the peat in the LMAZ 13. The first macroscopic charcoals date to the Neolithic period around 4350 cal BP (2400 BCE; Fig. 3) and likely reveal human activities around the lake, as indicated also by micro-charcoal (<250 µm) and the palynological results (Haas and Wahlmüller 2010), even if the exact location of possible settlements or single agricultural farm houses remains unknown so far. Other macro-charcoal finds were present during the very end of the Late Neolithic as well as during the Early Bronze Age around 4200, 4050 and 3950 cal BP (2250, 2100 and 2000 BCE), hinting again at local agricultural and settlement presence around the lake. The first occurrence of water lily remains (*Nuphar*; Fig. 3) does reveal a first eutrophication phase of Lake Bruszczewo around 4050 cal BP (2100 BCE), and is probably related to agricultural runoff of nutrients (nitrate, phosphate) or faeces towards the lake.

Thereafter, a huge peak in macro-charcoal around 3850 cal BP (1900 BCE) — together with macrofossils from cereals and eatable crop weeds (*Chenopodium* cf. *album*; Fig. 3) — is directly linked to the archaeologically excavated settlement area (Müller *et al.* 2010; Niebieszczański *et al.* 2023), dated to c. 2000–1650 BCE) on the Bruszczewo peninsula or spur in the Samica-oxbow-lake of Bruszczewo (see Fig. 1). This means, that even without archaeologically knowing the exact location of the contemporary Early Bronze Age (EBA) settlement and agricultural area, one would have expected or hypothesised a large village and agricultural fields directly on the littoral of the former lake Bruszczewo, as the naturally deposited sediments studied were extracted in the centre of the former lake about 150 m away from the archaeologically excavated settlement area. This now known EBA-village had an immense impact on the water quality of Lake Bruszczewo, as revealed by several macrofossil and microfossil (see Haas and Wahlmüller 2010)

finds of hydrophytes such as from *Nuphar*, *Nymphaea* (both plants also found as macrofossils in the study of Niebieszczański *et al.* 2023 for the same time period), and from *Potamogeton natans*, the latter found as fruits, and needing as a plant even very high nutrient amounts for their living cycles. The growth of the latter plant in highly eutrophic waters is therefore of interest, as the palynological study of the sediments revealed eggs from the human or animal parasite *Trichuris* (whipworm) in the centre of the lake (Haas and Wahlmüller 2010), meaning that excrements from humans or livestock must have entered the lake ecosystem between 3895 and 3865 cal BP (1945–1915 BCE) in huge amounts, resulting in high eutrophication levels of the lake water. It remains currently unclear, if this poor lake water quality may have affected the health or the EBA people living on the lake-side of Bruszczewo during that time. However, the concomitant presence of cyanobacteria in the lake, *i.e.* some *Gloeotrichia* and extremely high amounts of *Anabaena*, as well as spores from coprophilous fungi (Sodariaceae, *Podospora*, *Cercophora*), as revealed by the palynological study of Jean Nicolas Haas and Notburga Wahlmüller (2010), do pinpoint at rather poor water conditions during most of the EBA settlement period (2000–1650 BCE) likely due to agricultural runoff and faeces input (from humans or livestock) to the lake, possibly in relation to field manuring. However, given that these indicators for poor water quality prevail throughout the settlement phase, they may not have impacted the Bruszczewo societies too much, or the Bruszczewo people did use their clean drinking water from nearby wells unknown so far by archaeological means.

After the abandonment of the EBA settlement area around 3760 cal BP (1810 BCE) according to the palynological results (and around 1750 BCE according to the archaeological results), only very few macro-charcoal particles were found between 3700 and 3580 cal BP (1750–1630 BCE; Fig. 3). A somehow higher number of macro-charcoals at 3550 cal BP (1600 BCE)

may again represent human activities around the lake, even if the exact location of a potential settlement area is currently unknown.

Subsequently, and back to a huge abundance of macroscopic charcoal (up to 274 pieces per 7 g sediment in the centre of the lake) between 3320 and 3200 cal BP (1370–1250 BCE; Fig. 3), one again would hypothesise a huge settlement on the littoral of Lake Bruszczewo during the end of the Middle Bronze Age and beginning of the Late Bronze Age (LBA). This is especially interesting, as even if an urnfield cemetery is known, no settlement area around the lake is archaeologically known for this time span, up to now, *i.e.* archaeologists have yet to find the exact location of the according lake-side village of these husbandry societies in the future.

According to the concurrent presence of water lilies between 3230 and 3100 cal BP (1280–1150 BCE; Fig. 3), the water quality of the lake remained of poor quality, possibly somehow better than during the EBA, however still with a pretty high amount of nutrients in the water. Shortly after 3100 cal BP (1150 BCE) the water quality may have slightly improved during the LBA towards mesotrophic water conditions, as revealed by the first occurrence of macrofossils from the spiny naiad (*Najas marina* ssp. *intermedia*; Fig. 3), showing the slow resilience of such lake ecosystems in Poland since the EBA human impact.

Later, an archaeologically known settlement existed between *c.* 1000 and 800 BCE just southwest of the EBA peninsula settlement, according to the archaeological prospection and radiocarbon dates (Müller *et al.* 2010). Interestingly, this settlement is only very poorly represented in the macrofossil record presented here (Fig. 3), with the exception of relatively high macro-charcoal amounts between 2820 and 2780 cal BP (870–830 BCE), which therefore could rely to the final phase of this settlement. Possibly, this lake-side village aimed not only at some – eventually part-time and relatively insignificant – agricultural activity (as quantified by Haas and Wahlmüller 2010), but had also some other sustainability functions, importance and duties in the according Greater Poland area during the Late Bronze Age.

Shortly thereafter, at the transition between the LBA and Iron Age, the water quality of Lake Bruszczewo must have dramatically improved within a very short time period. Around 2750 cal BP (800 BCE) the meso- to eutrophic water lilies (*Nuphar* and *Nymphaea*) abruptly disappear for some centuries, and are replaced by slender naiads (*Najas flexilis*) in the shallow waters of the lake (0.5 to 4 m deep), which is

documented for the first time at Lake Bruszczewo, and reveal oligotrophic to only slightly mesotrophic water conditions in terms of nutrients. This rare species for Poland (and Central Europe) today was not found as macrofossils in the study of Jakub Niebieszczański *et al.* (2023) for this time period, probably because of the small sediment samples used in their study. Obviously, the recovery of the lake quality happened within a decade or so, given that *Najas flexilis* would not grow in highly mesotrophic to eutrophic waters, showing the high recovery capacity of lake ecosystems at that time in Poland. Given that slender naiads are nearly extinct all over Europe, and belong to the red list plant species in Poland with a few extant localities known today, these prehistorical findings from Lake Bruszczewo are of high relevance in terms of the past distribution of *Najas flexilis* in Poland and Central Europe.

During the Iron Age and until at least *ca.* 2200 cal BP (*ca.* 250 BCE; Fig. 3) the water quality was likely again more mesotrophic than oligotrophic, given that water lilies (*Nuphar* and *Nymphaea*, both plants also found as macrofossils in the study of Jakub Niebieszczański *et al.* (2023) for this time period) and spiny naiads were present again, but no slender naiads anymore. The regular occurrence of macro-charcoal may represent human and agricultural activities during these Iron Age times, even if according settlement structures are unknown until today. The lake water quality situation changed again around 2080 cal BP (130 BCE; Fig. 3) when slender naiads were again present in Lake Bruszczewo, so representing again oligotrophic to slightly mesotrophic (given the remarkably high amounts of spiny naiads) water conditions relatively poor in nutrients, until the subsequent, complete terrestrialisation of the lake towards the current bog environment.

In summary, high-resolution analyses and quantification of macroscopic charcoal particles and macrofossils from hydrophyte remains from naturally grown lake sediments are major proxies for the detection of prehistorical settlements and husbandry systems, as already suggested by Jean Nicolas Haas and Philippe Hadorn (1998) for Lake Nussbaumersee in Switzerland. In addition, the value of hydrophyte and faunal remains found in such macrofossil studies do highly add to the reconstruction of prehistorical lake water pollution, as well as on the impact of prehistorical societies and their agrarian systems on the water quality of freshwater lakes and their ecosystems.

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APPENDIX

Appendix 1. Age-Depth model compilation for the sediment stratigraphy extracted from the former Bruszczewo lake, Poland (BRU-16/5.5; land surface at 69.10 m a.s.l.) as performed in “clam” (Blaauw 2010; version 2.4.0) available in R (R Core Team 2021; version 4.1.2) by linear interpolation of the radiocarbon ages. Mention (from left to right) of coring depth, modelled minimum and maximum age (at 95 % confidence interval) for the 78 studied sediment depths, the modelled absolute age (“best”, in cal. BP; i.e. cal. before AD 1950) and the standard deviation (“accrate”).

Depth	Min. 95 %	Max. 95 %	Best	Accrate	Depth	Min. 95 %	Max. 95 %	Best	Accrate
56.5	1278.4	1470.0	1366.9	25.079	213.5	2920.3	3168.4	3046.7	9.949
57.5	1301.9	1496.9	1392.0	25.079	216.5	2953.7	3194.2	3076.6	9.949
58.5	1325.4	1523.8	1417.1	25.079	217.5	2965.0	3202.8	3086.5	9.949
59.5	1348.9	1550.7	1442.2	25.079	218.5	2976.4	3211.4	3096.5	9.949
89.5	1938.4	2175.2	2052.7	10.147	219.5	2988.0	3220.1	3106.4	9.949
90.5	1949.5	2184.8	2062.8	10.147	220.5	2999.7	3229.6	3116.4	9.949
91.5	1960.3	2192.0	2073.0	10.147	221.5	3011.2	3237.2	3126.3	9.949
92.5	1970.6	2201.4	2083.1	10.147	228.5	3089.9	3300.6	3196.0	9.949
106.5	2120.9	2362.9	2225.2	10.147	229.5	3101.6	3309.2	3205.9	9.949
107.5	2130.1	2375.6	2235.3	10.147	230.5	3113.6	3318.4	3215.9	9.949
108.5	2139.7	2388.3	2245.5	10.147	231.5	3125.6	3327.5	3225.8	9.949
118.5	2235.8	2517.1	2347.0	10.147	232.5	3137.6	3336.7	3235.8	9.949
121.5	2264.2	2558.8	2377.4	10.147	233.5	3149.0	3345.6	3245.7	9.949
122.5	2273.3	2571.3	2387.5	10.147	236.5	3182.2	3372.4	3275.6	9.949
123.5	2281.6	2583.8	2397.7	10.147	237.5	3192.6	3381.5	3285.5	9.949
138.5	2406.9	2722.5	2525.2	6.851	238.5	3203.3	3390.7	3295.5	9.949
141.5	2429.7	2736.7	2545.7	6.851	239.5	3214.2	3400.5	3305.4	9.949
142.5	2437.5	2741.1	2552.6	6.851	240.5	3224.1	3410.3	3315.4	9.949
143.5	2445.4	2745.1	2559.4	6.851	262.5	3442.2	3615.1	3534.3	9.949
156.5	2545.6	2808.5	2648.5	6.851	263.5	3451.7	3626.0	3544.2	9.949
157.5	2553.6	2812.9	2655.3	6.851	266.5	3479.2	3657.5	3574.1	9.949
158.5	2561.1	2817.3	2662.2	6.851	278.5	3589.9	3788.9	3693.4	9.949
159.5	2568.6	2821.9	2669.0	6.851	281.5	3617.3	3822.1	3723.3	9.949
160.5	2576.4	2826.9	2675.9	6.851	296.5	3747.3	3971.2	3861.8	5.665
170.5	2650.5	2881.7	2744.4	6.851	311.0	3844.0	4044.7	3944.0	5.665
171.5	2656.8	2887.5	2751.3	6.851	313.0	3857.9	4057.2	3955.3	5.665
172.5	2664.4	2892.9	2758.1	6.851	315.0	3868.0	4071.5	3966.6	5.665
173.5	2671.5	2898.6	2765.0	6.851	316.0	3873.2	4080.6	3972.3	5.665
176.5	2690.9	2915.6	2785.5	6.851	317.0	3878.7	4089.5	3978.0	5.665
177.5	2697.4	2922.0	2792.4	6.851	330.5	3929.1	4203.0	4054.4	5.665
178.5	2704.2	2926.7	2799.2	6.851	331.5	3934.5	4213.6	4060.1	5.665
179.5	2711.2	2932.4	2806.1	6.851	332.5	3939.9	4223.9	4065.8	5.665
180.5	2717.6	2938.8	2812.9	6.851	333.5	3944.5	4234.6	4071.4	5.665
193.5	2794.0	3019.1	2902.0	6.851	336.5	3955.6	4265.3	4088.4	5.665
206.0	2864.1	3104.8	2987.6	6.851	353.5	4009.1	4442.3	4184.7	5.665
209.5	2882.8	3134.2	3011.6	6.851	356.5	4013.7	4473.9	4201.7	5.665
210.5	2887.2	3142.9	3018.4	6.851	376.5	4054.7	4682.2	4315.0	5.665
211.5	2896.8	3151.5	3026.8	9.949	377.5	4056.3	4692.2	4320.7	5.665
212.5	2908.4	3160.3	3036.8	9.949	378.5	4058.8	4702.3	4326.4	5.665

Life, Landscape and Rituals – Funnel Beaker Human Remains from the Domestic Site Oldenburg-Dannau in Context of the Southern Cimbrian Peninsula

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KEYWORDS: Funnel Beaker societies, human remains, environmental change, burial practices, Middle Neolithic Northern Europe

Abstract

The domestic site Oldenburg-Dannau LA 77, situated in the lowland area of the Oldenburger Graben in Schleswig-Holstein, offers rare insights into the life and socio-ritual practices of Funnel Beaker societies in Middle Neolithic Northern Germany due to the excellent preservation of archaeological finds. This article summarises the latest results of interdisciplinary studies and places them in the regional research context.

The archaeological investigations of the last fifteen years point to a peak phase of human activity around 3100 BCE, which is characterised by the emergence of the village settlement structure of Oldenburg-Dannau. The human skeletal remains found here provide new information on living conditions, diet and unusual mortuary practices. Palaeoecological archives bear witness

to environmental changes that accompanied the rise in sea level and its influence on local settlement patterns. These are visible in sedimentation processes with erosion and deposition, including the relocation of human remains and material culture. The finds from LA 77 and those from other Funnel Beaker sites suggest that mortuary rituals took place both inside and outside settlements and played a crucial role in the socio-cultural identity and complexity of these communities.

These observations contrast with the relatively uniform material culture of the Funnel Beaker North Group and the unifying aspect of collective burials in megalithic tombs. The findings illustrate the benefits of high-resolution local palaeoecological and archaeological archives for supra-regional phenomena.

Zusammenfassung

Im Niederungsgebiet des Oldenburger Grabens in Schleswig-Holstein liegt der Siedlungsfundplatz Oldenburg-Dannau LA 77, der aufgrund der exzellenten Erhaltung archäologischer Funde seltene Einblicke in das Leben und die soziorituellen Praktiken der Trichterbechergesellschaften im mittelnolithischen Norddeutschland bietet. In diesem Artikel werden aktuelle Ergebnisse interdisziplinärer Studien zusammenfasst und in den regionalen Forschungskontext gestellt.

Die archäologischen Untersuchungen der letzten 15 Jahre weisen auf eine Hochphase menschlicher Aktivität um 3100 v. Chr. hin, die durch die Entstehung der dörflichen Siedlungsstruktur von Oldenburg-Dannau gekennzeichnet ist. Die hier aufgefundenen menschlichen Skelettreste liefern neue Erkenntnisse zu Lebensbedingungen, Ernährung und außergewöhnliche Praktiken der Totenbehandlung. Paläoökologische Archive zeugen von Umweltveränderungen, die mit dem An-

stieg des Meeresspiegels und dessen Einfluss auf lokale Siedlungsmuster einhergingen. Sichtbar sind diese in Sedimentierungsprozessen mit Erosionen und Ablagerungen, inklusive der Verlagerungen menschlicher Überreste und materieller Kultur. Die Funde von LA 77 und solche anderer trichterbecherzeitlicher Fundplätze legen nahe, dass Totenrituale auch innerhalb und außerhalb von Siedlungen stattfanden und eine entscheidende Rolle für die soziokulturelle Identität und Komplexität dieser Gemeinschaften spielten.

Diese Beobachtungen stehen im Kontrast zu der relativ gleichförmigen materiellen Kultur der Trichterbecher-Nordgruppe und dem verbindenden Aspekt der Kollektivbestattung in Megalithgräbern. Sie verdeutlichen den Nutzen hochauflösender lokaler paläoökologischer und archäologischer Archive für überregionale Phänomene.

INTRODUCTION

Researching Neolithic Schleswig-Holstein, Northern Germany, there is a region you can't get past — the Oldenburger Graben, a 23 km long and up to 3 km wide lowland area in Ostholstein, and its vicinity (Fig. 1A). It's exceptional preservation conditions of a wetland environment offers an archaeological heritage. Shaped mainly by changing sea levels over the course of time, the diverse natural landscape already offered an ideal habitat for Neolithic settlers. People of the Funnel Beaker groups (Midgley 1992; Müller 2011a) settled on the sand islands next to the marshy shores and buried their deceased in numerous megalithic tombs of the region, constructions of early monumentality in prehistoric Europe (Brozio 2016; Mennenga 2016; Müller 2019).

Archaeological research in the Oldenburger Graben is characterized by a large number of sites, many of which were discovered by interested observers or collectors. Since the middle of the 20th century, excavations of settlement sites have provided unique insights into prehistoric life, particularly for the Mesolithic and Neolithic periods (Hoika 1982; 1987; Meures-Balke 1983; Hartz and Hoffmann-Wieck 2000; Hartz 2002; Kühl 2002; Brozio 2020a). Since 2009, the area has been in recent scientific spotlight thanks to the archaeological research funded by the Priority Program 1400 (SPP 1400) "Early Monumentality and Social Differentiation" (Hinz and Müller 2012; Müller *et al.* 2019) as well as the Collaborative Research Centre 1266 "Scales of Transformations in Prehistoric and Archaic Societies". In this, Johannes Müller, to whom we dedicate this article, played a decisive role; not only as the initiator and speaker of both funding projects, but by bringing forward the interdisciplinary research that took place in the Oldenburger Graben in the last 25 years (Müller 2009; 2010; 2011a; 2014; Hinz and Müller 2012; Brozio *et al.* 2014; Müller and Hartz 2017; Feeser and Dörfler 2019a; 2019b; Filipović *et al.* 2019; Knitter *et al.* 2019a; 2019b; Müller *et al.* 2019; Weber *et al.* 2020).

With the adoption of agriculture and animal husbandry and the drastic changes in lifestyle that these brought, the final phase of the Stone Age began around 4100 BCE in northern Germany and southern Scandinavia. In Schleswig-Holstein, a cultural phenomenon developed during the transition from the Late Mesolithic (Ertebølle) to the Early Neolithic, which is known as the Funnel Beaker groups due to the characteristic shape of its vessels (Müller and Peterson 2015). The settlement sites consisted of individual farmsteads, such as the 18 metre long and 7-metre-wide house site of Rastorf LA 6, in the immediate vicinity of which the cultivated farmland was located (Steffens 2009). Hereby the Oldenburg LA 77

settlement site, in contrast, had a different character and played since 2009 a central role in the research of the last decades.

The site Oldenburg-Dannau LA 77 is located on an elevation of c. 3 ha with a WNW-ESE orientation, which is approximately 280 m long and 125 m wide (Fig. 1B). Geologically, this elevation belongs to a group of sandy hills in the wetlands of the Oldenburger Graben, reaching up to +0.8 m a.s.l. The site was once part of a larger settlement system whose inhabitants used the prehistoric islands and peninsulas as a settlement area and the peripheral areas of the Oldenburger Graben for agriculture. Burial sites, such as the megalithic grave Wangels LA 69, were constructed on the adjacent north and south moraine tracts (Brozio 2016; 2019).

With the exception of its western part, the entire archaeological site Oldenburg-Dannau LA 77 is covered with a settlement layer of varying preservation (Fig. 1C). Remarkable is the amount of organic material, such as botanical macro remains, wood and bones, found in the former prehistoric riparian zone and on the terrain elevation. Apart from usual settlement features such as pits and post holes, two well structures were discovered (Brozio 2013; Brozio *et al.* 2014). Furthermore, rows of post holes revealed the remains of an architectural structure that once surrounded the settlement area.

Through the location and compilation of artefacts, five houses of the 'Mossby' Funnel Beaker type and several huts could be identified. Using a spatial analysis of the artefacts from the settlement layer — considering house and open spaces as well as other defined features — individual areas of the settlement could be distinguished by different functional characters and formation processes. In particular, intentional waste disposal in the disused wells and in the prehistoric riparian zones were observed (Brozio *et al.* 2014). The chronological assignment of the settlement cultural material, which typology is associated with the southern form of the Funnel Beaker North Group, dates the inhabitation of this sandy island between 3270 and 2920 cal BC. On this basis, it was possible to distinguish three settlement phases (Brozio 2016):

- Oldenburg 1: 3270–3110 cal BC
- Oldenburg 2: 3110–3020 cal BC
- Oldenburg 3A: 3020–2990 cal BC
- Oldenburg 3B: 2990–2920 cal BC

Exceptional was the discovery of human remains from different archaeological contexts: two features interpreted as burials (1 and 2) between house features and accumulations of disarticulated and loose bones

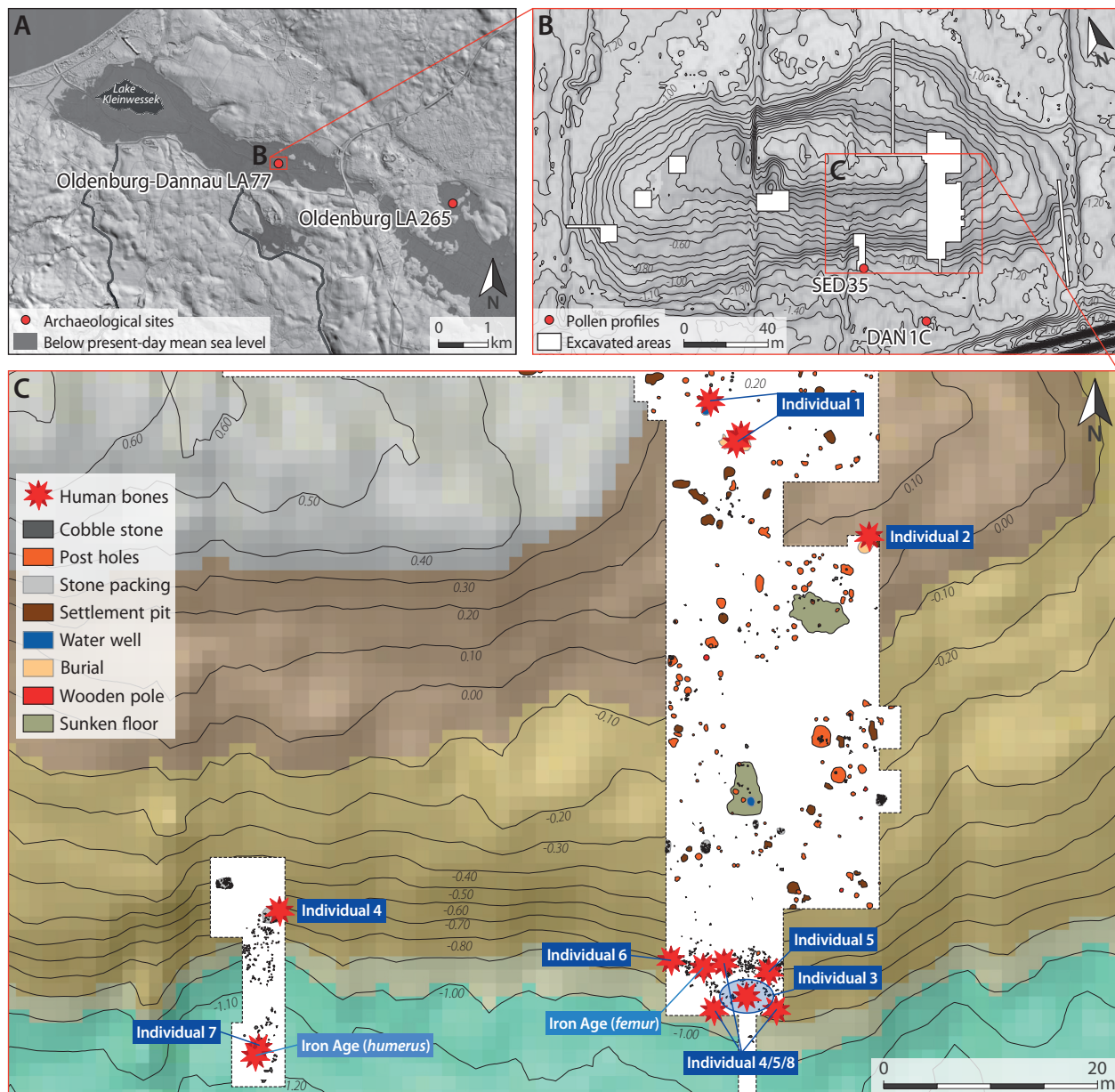


Fig. 1. A Region of the Oldenburger Graben and geographic location the settlement Oldenburg-Dannau LA 77 and adjacent Funnel Beaker sites; B Map of Oldenburg-Dannau settlement area, outlines of excavations trenches and locations of sampling for pollen analyses (Feaser *et al.* 2019b); C Excavation map of trench 1 (right) and 2 (left) with locations of archaeological finds, including burials/human bones, sunken floor of house 1 and hut 1 and well 1.

near or in the prehistoric shore area (Fig. 1C, red star labels). Finds of prehistoric human remains in Schleswig-Holstein, especially in good state of preservation, are rare — not only for the times of the Funnel Beaker groups (Wunderlich *et al.* 2014; Henke 1981; Brozio 2016; Hartz *et al.* 2007; Mischka *et al.* 2007; 2022). The Oldenburger Graben, with its favourable conditions for the conservation of osteological and organic material, is an exception. Previous and more recent analysis of human skeletal remains from this regional context demonstrate this (Fuchs 2016; 2021).

Furthermore, systematic archaeobotanical (Filipović *et al.* 2019; Kirleis 2019; Kubiak-Martens *et al.* 2024) and palaeoenvironmental investigations (Feaser and Dörfler 2019b) in context of the archaeological investigations facilitated a detailed reconstruction of subsistence and land-use activities for the settlement site and further shed light on local settlement dynamics in context of changing environmental conditions.

The interdisciplinary approach of integrating and combining archaeological and environmental context allows new perspectives on the phenomenon of

human remains within Neolithic settlements and provides new insights to Neolithic burial activities during phases of socio-cultural transformation. In this article, we herewith present some new results on the human remains recovered at the Funnel Beaker settlement site

Oldenburg-Dannau (LA 77) along a discussion on archaeological, palaeoenvironmental and socio-ritual significance on local (site-level) to over-regional (Southern Cimbrian Peninsula) scale.

OLDENBURG-DANNAU LA 77 HUMAN REMAINS: LIFE AND DEATH

First results on the human skeletal finds discovered during early excavations of the settlement site and its adjacent ancient shore lines conducted by the SPP 1400 are already published (Fuchs 2016). Since then, additional bones have been investigated and the complete material was analysed in-depth, resulting in a new minimal number of individuals and allowing insights into their life and deaths.

Overall, the remains of at least seven individuals were found, represented by bone fragments of skeletons with and without anatomic articulation and by

isolated bone finds (Fig. 1C). Notable is the difference in preservation, clearly associated with poorer preservation in sandy (airy, high water-permeability; Fig. 2A–B) and excellent preservation in waterlogged, muddy soil (stagnant cold temperatures and alkaline groundwater, low-oxygen environment; Fig. 2C–D).

For exploiting the human remains with regard to information on Neolithic life in the Oldenburger Graben, all bone and dental material has been analysed for age-at-death (see Buikstra and Ubelaker 1994; Lovejoy *et al.* 1985; Miles 1963; Szilvássy 1988; Grupe *et al.* 2015),

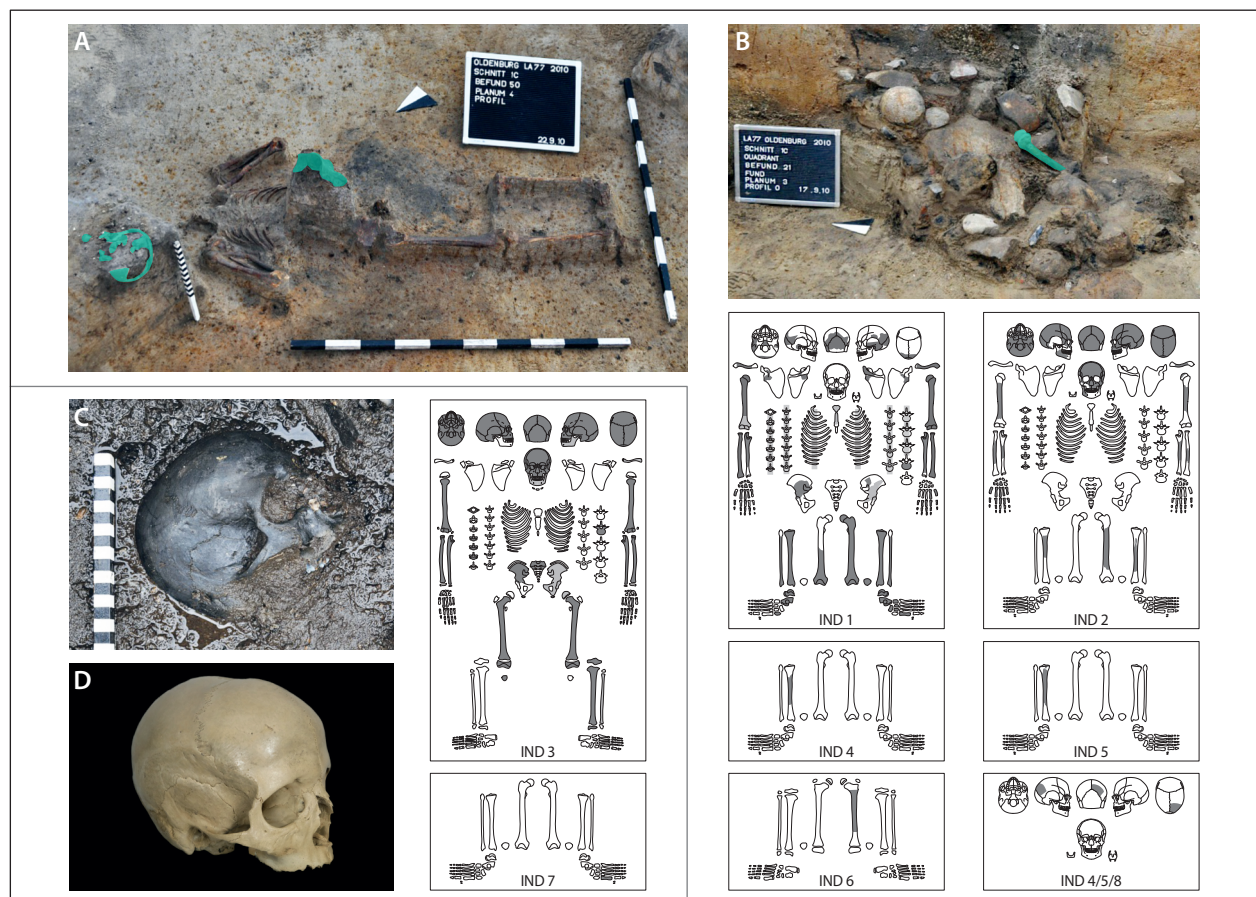


Fig. 2. Human bone finds and skeletal preservation at Oldenburg-Dannau LA 77. A and B In situ situation of individual 1 and find of the associated femur in well 1. Green colour marks the disarticulated bones (A skull and right pelvis; B distal part of the right femur). C–D In situ situation in the peat soil and later picture of the skull associated with individual 3; other: Overview of skeletal preservation and associations to individuals 1–7 (Graphic: Katharina Fuchs).

morphological sex (see Buikstra and Ubelaker 1994; Sjøvold 1988; Grupe *et al.* 2015), osteometric aspects and body height (Bach 1965; Ruff *et al.* 2012), as well as habitual and pathological alterations (see Ortner 2003; Weber *et al.* 2022). Unfortunately, conducted palaeogenetic analyses were unsuccessful. New radiocarbon dates¹ allow to discuss both a connection between the skeletally represented individuals and the Funnel Beaker settlement as well as their significance for Neolithic transformations in burial customs towards the Single Grave groups (SGC) in Northern Germany (see Discussion).

Individual 1

The skeletal remains of two individuals were found in immediate vicinity of house and pit structures located in the south-western area of the settlement (Fig. 1C). Most notable is individual 1, a middle-aged woman who found its final rest in stretched and prone body position, tightly angled arms with hands underneath the shoulders, and with a missing right femur, displaced right pelvic bone and patella, and the skull found in 24cm above and 30cm lateral offset (Brozio 2016, 44–45;

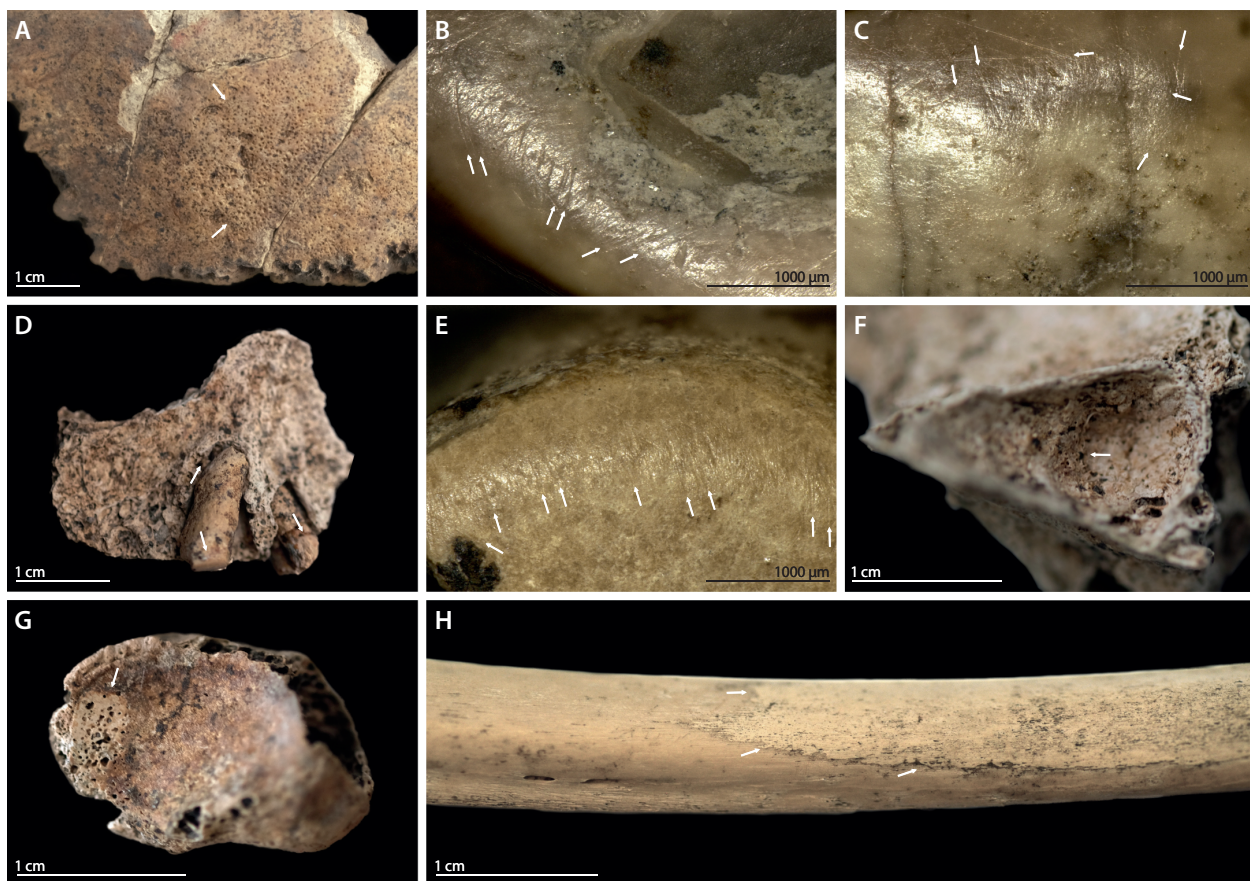


Fig. 3. Examples of human bones found at Oldenburg-Dannau LA 77 showing dental and palaeopathological observations. A–D Individual 1, woman, middle adult; A right parietal with periosteal reactions, probably due to inflammatory processes; B–C Individual 1, pictures taken with a digital microscope (x 100 magnification) showing irregular patterns of dental microwear on the tooth crown enamel, induced by chewing on hard substances (molar 36, A occlusal surface, B lingual surface); D–E individual 2, probably male, old adult; D left maxilla with intravital tooth loss of both incisors, heavily eroded canine and first premolar, and periapical access; E Digital microscope picture (x 100 magnification) showing the occlusal surface of the canine root with a rounded buccal pattern of microwear scratches. F Bottom of maxillary sinus exhibiting pitting and irregular spicular new bone formation typical for a chronic sinusitis; G Joint surface of the right thumb (metacarpophalangeal joint) with a patch of eburnation; H Individual 3, juvenile. 5th left rib (sternal half of the shaft, visceral surface) with distinct layer of new bone formation, probably due to bleeding/inflammation (Scale: 1 cm; photos: Katharina Fuchs).

1 For sample preparation and measurement protocol, see Jan Piet Brozio (2016) and information provided by the Poznań Radiocarbon Laboratory.

Table 1 (double page). New and published radiocarbon data for Oldenburg-Dannau LA 77 (OLD 77) and Oldenburg LA 265 (OLD 265, Fuchs 2021): individual representation, archaeological context, osteological data, sample information and results.

Sample no.	OLD ind.	Find context	Find character	Age-at-death
OLD 77-01	1	Cultural layer of the settlement, sandy soil	Burial 1, grave pit in settlement, secondary activity	Middle adult (35–45 years)
OLD 77-02 OLD 77-02-comb	2	Cultural layer of the settlement, sandy soil	Burial 2, grave pit in settlement	Old adult (45–60+ years)
OLD 77-03	3	Shore area, dark peat	Disarticulated skeleton, disturbed	Juvenile (13– years)
OLD 77-04	4	Close to shoreline, cultural layer	Single bone	Adult 20–60+ years)
OLD 77-04/5	4/5/8?	Prehistoric shore area, disturbed sandy layer above cultural layer	Single bone (dislocated)	Adult (20–60+ years)
OLD 77-05	5	Prehistoric shore area, disturbed sandy layer above cultural layer	Single bone (dislocated)	Adult (20–60+ years)
OLD 77-06	6	Prehistoric shore area, disturbed sandy layer above cultural layer	Single bone (dislocated?)	Old child (8–12 years)
OLD 77-07	7	Prehistoric shore area, unclear	Single bone (dislocated?)	Adult (20–60+ years)
(OLD 77)	none	Prehistoric shore area, unclear	Single bone (dislocated?)	Adult (20–60+ years)
(OLD 77)	none	Prehistoric shore area, disturbed sandy layer above cultural layer	Single bone	Adult (20–60+ years)
OLD 265-UK1	2, 4, 5; OK1?	Prehistoric shore area, gyttja-sandy mixed layer	Single bone	Middle adult (30–45 years)
OLD 265-OK2	1?		Single bone	Juvenile-young adult (17–25 years)
OLD 265-01	1		One of two skull bones	Juvenile-young adult (15–30 years)
OLD 265-02	4		Single bone	Adult (20–60+ years)

Fuchs 2016; Fig. 2A). The distal half of the right femur was found on the bottom of a well located in less than 2 m distance (cf. Brozio *et al.* 2014; Fig. 2B), amidst a cultural layer containing stones, ceramic sherds, animal bones and botanical remains. The main part of the skeleton laid on spotty yellow-brownish and sandy soil, with an eye-catching dark discolouration around the hip and thigh, which indicates a subsequent digging activity (Fig. 2A). Such a mark is missing around the cranial remains. Any manipulations, such as cut marks, traces of animal scavenging or other postmortem handling of the bones are absent. Interestingly, the position of the skeleton is suggestive for an abdominal fall of the women, trying to catch herself and hitting the ground on hands and arms angled.

The time interval between the death of the woman and the disruption could have been several years or decades, given the decay of soft tissues in sandy, rather humid and oxygenated soils (Janaway *et al.* 2009). Modelled radiocarbon dates of plant remains from different five stratigraphic layers of the well filling suggest that its fill, prior to its primary use as a water resource, coincides with the habitation of house 3 around 3100–3000 BCE (settlement phase 2; Fig. 5).

The new radiocarbon date from the femur has a longer 2sigma-range (3346–3028 cal BC, Table 1), and since the bone was found in layer 5, which is one of the oldest cultural layer of the filling (Brozio *et al.* 2014, 138; Fig. 2B), this might mark the time between the woman's death and the later deposition of her femur in the well. For this find, different scenarios are possible. One would be an intentional and targeted removal, which would mean knowledge where the body was located, or accidental find of the woman's remains. The disturbance of both skull and hip might have been associated with constructing house 3 (Brozio 2016, 106 fig. 99). Perhaps, during this process, the builder came across the decaying body, pushed skull and cervical spine aside, tore away pelvis, femur and patella, seemingly still attached by soft tissue. For the former, the state of articulation remains unclear since the cervical spine has not been found. The lurid assumption of a case of peri- or postmortem beheading might as well be obvious, yet we do not have any osteological evidence for this. In any case, the intentionality this body deposition and thus its mortuary background remains unclear. However, it is highly probable that this woman lived and died during the first phase of the settlement

For OLD 77-02, the dates are not reliable due to the poor collagen preservation for the POZ samples and the KIA sample being too old.

Morph. sex	Lab. no.	Bone sample	% coll yield	¹⁴ C age BP	SD	σ1–range cal	σ2–range cal
Female	Poz-140861	Femur diaphysis (right)	2.30	4480	35	3331–3097 BC	3346–3028 BC
Male	KIA-49468	Femur diaphysis (right)	-	5095	40	3960–3804 BC	3976–3791 BC
	Poz-138730	Femur diaphysis (right)	0.13	4105	35	2840–2579 BC	2859–2502 BC
	Poz-138731	Parietal (skull)	0.12	4090	35		
n.d.	Poz-138308	Rib (right)	9.20	4410	40	2850–2581 BC	2872–2501 BC
n.d.	Poz-138309	Tibia diaphysis (right)	5.10	4520	40	3355–3105 BC	3365–3095 BC
n.d.	Poz-138312	Parietal (skull)	3.70	4460	40	3328–3029 BC	3345–2937 BC
n.d.	Poz-138310	Tibia diaphysis (right)	7.50	4500	40	3338–3103 BC	3359–3034 BC
n.d.	Poz-138311	Femur diaphysis (left)	5.40	4390	40	3082–2923 BC	3315–2904 BC
n.d.	Poz-138732	1. Metatarsal (left)	1.30	3675	35	2135–1981 BC	2193–1950 BC
(male)	Poz-138313	Humerus diaphysis (left)	8.90	1750	39	409–533 AD	382–541 AD
(male)	Poz-138314	Femur diaphysis (left)	9.30	1630	30	247–345 AD	239–401 AD
n.d.	KIA-54430	Mandible	-	4467	26	3327–3040 BC	3337–3027 BC
(male)	KIA-54431	Maxilla	-	4447	24	3315–3026 BC	3333–3012 BC
n.d.	KIA-54432	Parietal (skull, left)	-	4406	25	3090–2933 BC	3262–2918 BC
(male)	KIA-54433	Parietal (skull, left)	-	4366	25	3011–2920 BC	3081–2908 BC

(3270–3110 cal BC),² which makes her a probable inhabitant of the Middle Neolithic Oldenburg-Dannau village (Fig. 5).

Her skeletal remains (75–50% preserved, Fig. 2) show typical signs of degeneration, *e.g.* in the spine, the larger joints, and the bones of hand and feet, as expectable for a middle-aged, physically active woman. Signs of inflammatory changes are visible on bone surfaces of the sinus, the alveolar and the scalp area (Fig. 3A), which suggest a long-term, but moderate burden of infection-related processes. Exhibiting moderate occlusal and irregular microwear with deeper scrapes (Fig. 3B–C), punctual enamel fractures and a small caries lesion, her few preserved teeth demonstrate that she consumed cariogenic foodstuffs that contained hard components. This resembles with a plant-based diet, admixture of grinding residues in cereal products, which fits the food economy practices described for this settlement and the Funnel Beaker Culture (TBK) in general (*cf.* paragraph on subsistence below; Smith 1984). The woman reached a height between 150–160 cm, was

of gracile stature but strong in terms of her musculoskeletal apparatus.

Individual 2

The skeleton of individual 2, found next to remains of house structures (posts, sunken floor, Fig. 1C) is less well-preserved (50–25%) by mainly skull bones, long bone fragments and hand bones (Fig. 3). When recovered, the skull rested on the right hand, sunken on the left shoulder; the lack of associated artefacts speaks against a careful burial. Few assessable morphological features suggest a tendency towards a male, while severe dental wear, high rate of intra-vital tooth loss, cranial suture closure, cortical porosity and joint degeneration argue for a significantly older age-at-death compared to individual 1. Most notably is his oral health status, characterised by several apical inflammatory processes, advanced alveolar atrophy due to periodontitis and an upper canine and premolar worn down

² All radiocarbon dates are 2sigma-ranges; see Table 1.

to their root; two tooth stumps, hardly anchored in abscess cavities, and similar in the small lower jaw fragment, suggest significant restriction and discomfort when chewing for a longer time before death (Fig. 3E). The direction of occlusal scratches on rounded anterior root indicates that this heavy abrasion might have been caused by other processes as mastication, such as using teeth for occupational tasks (Hinton 1981; Molnar 2011). Growing old with health issues is also indicated by chronic infections of the sinuses (Fig. 3F) and inflammatory reactions in the meningeal areas. All these observations are not exceptional for Neolithic populations, but it is remarkable that this male survived long enough to develop these advanced stages. This matches with severe degeneration in his right hand, specifically the thumb, up to eburnation of joint surfaces (Fig. 3G). Such damage is associated with overload due to repetitive habitual tasks or diseases such as rheumatoid arthritis (Lagier 2006). Archaeologically, similar to the female individual, this male is connected to the settlement structures. Radiocarbon dating, however, remains inconclusive due to the very poor collagen preservation in three samples (0.8–0.1 % yield, not passing the quality criteria). We obtained very different results (3976 to 3791 cal BC and 2776–2565 cal BC; Table 1), with both 2sigma-ranges being either much older or much younger than other dates obtained from settlement material (Fig. 5, greyed dates; Table 1), and we assume that neither of them is actually correct.

Individual 3

Skeletal remains of individuals 3–7 were recovered close to or in the prehistoric shore line in a peat layer (Brozio 2016; Fig. 1C), which according to the palaeoenvironmental investigations formed between 2900/2700 and 1000 BCE. The bones of the juvenile individual 3 (13–15 years), probably male, was perfectly conserved in the air-sealing peaty soil with black discolouration, which turned greyish-green when cleaned and dried in oxygen exposure (Brozio 2016, 46; Fig. 2C–D). The bones were scattered and excavated in different field campaigns, yet their association to the same individual is without doubt due to the distinct morphology and developmental stage (Fuchs 2016). Remarkable about this young individual are rare anatomical variants of the skull, such as a metopic suture, accessory ossicles in the occipital suture and shape of the supraorbital foramen. Calcifications on the inside of the 5th to the 7th rib suggest a serious lung or pleural disease, most probably still active when the juvenile died (Fig. 3H). More health problems are indicated by an anaemic reaction due increased blood loss, metabolic disorders or infection, visible on the orbital roofs, as well as other haemorrhagic

processes on the skull and long bones, perhaps due to a vitamin C deficiency (Klaus 2017). Thus, a very different history of life compared to individuals 1 and 2. According to the radiocarbon dates, this juvenile also lived and died much later (2872–2501 cal BC, Table 1; Fig. 5), associated with the Single Grave groups (SGC). Regarding the archaeological context, this find could either represent a disturbed grave, with the human remains washed away and dislocated by flooding, the consequence of an accident of the juvenile in the boggy underground, or a rare burial ritual that involved the peatland area.

Individuals 4–7

The other four individuals are each represented by single bones (Fig. 2): two left tibia fragments of adult individuals, one in the cultural layer near the prehistoric shore line of the western trench area (3365–3095 cal BC, individual 4; Table 1; Fig. 1C, 2, 6) and another one found in the shore conglomerate (3359–3090 cal BC, individual 5; Table 1; Fig. 1C, 2, 5), next to the remains of individuals 3 and 6. These shin bones differ in robusticity and shape, indicating different activity habits of the two individuals. A cranial fragment found in this area, dating in the same time range, might belong to one of these two adults (individual 4/5/8+, 3345–3011 cal BC; Table 1; Fig. 1C, 2, 5), but could as well represent an additional individual. Same applies for small tibia and calcaneus fragments. The individual 6 was identified by a left femur diaphysis of another subadult, younger than individual 3, and its radiocarbon range spans the millennium transition (3105–2905 cal BC; Table 1; Fig. 1C, 2). The youngest radiocarbon date was measured for a metatarsal of an adult, individual 7 (2193–1950 cal BC; Table 1; Fig. 1C, 2, 5), and thus can be associated with the Late Neolithic Dagger period.

Except for the tibia of individual 4, which is associated with the cultural layer of the settlement at the edge of the prehistoric shore line, all other bones were located in a sandy layer that was deposited from above the outflowing cultural layer in the shore area. This is most likely a disturbed alluvial layer of the sand island, which has formed during period of maximum water levels in the Oldenburger Graben after c. 1000 BCE (see section below) and contained settlement waste and these human bones. The disturbed character is also evident by the presence of human bones from the Iron Age (Table 1; Fig. 1C, 5).

Although these single bone fragments do not allow detailed insight into past live at Oldenburg-Dannau, their quantity and dating, together with the findings for individuals 1–3, deliver food for thoughts regarding mortuary practices spanning the Middle and the Final Neolithic.

OLDENBURG-DANNAU LA 77: CHANGES IN ENVIRONMENT, LAND USE AND SUBSISTENCE

In context of archaeological investigations at the site Oldenburg-Dannau LA 77 (Brozio 2016) extensive pollen analytical investigations were carried out (Feeser and Dörfler 2019b). Therefore, several peat and sediment profiles were analysed, from the vicinity of the settlement, *i.e.* in the former near shore area, which allowed the detailed reconstruction of the natural environmental and land-use history in this part of the Oldenburger Graben. The presented diagram (Fig. 4) combines results from two profiles and covers the period between *c.* 5500–2000 BCE. The location of the longer profile DAN 1C was located *c.* 40 m south of the excavation area towards the lower lying area of the Oldenburger Graben (Fig. 1B). Sedimentation began here in the early Atlantic period, but subsequently rising water levels and probably near-shore dynamics resulted in an erosional hiatus, spanning the time 4300–2700 BCE. This gap can be largely covered by data from profile SED35 from the southern part of an excavation trench, which is located *c.* 50 m northwest on somewhat more elevated ground. Here the investigated section spans the time between *c.* 3800–2500 BCE. The palaeoenvironmental history can be reconstructed on the basis of chemical and physical sediment properties (sediment description, XRF analysis, loss on ignition) as well as macro remain (sieve fraction >0.2 mm), pollen and non-pollen palynomorph analyses (Feeser and Dörfler 2019b). The presented diagram (Fig. 4) gives a summary of the most important curves and indicators.

Environmental change in context of the postglacial sea level rise

From around *c.* 6000 BCE the postglacial transgression reached the glacial valley of the Oldenburger Graben and subsequently led to higher water levels and increasing flooding of lowland areas (Jakobsen 2005). In the pollen diagrams this is reflected by the replacement of oak (*Quercus*) dominated woodlands by alder (*Alnus gultinosa*) carr in course of the 6th millennium BCE (LPAZ 1, cf. Fig. 4). At around 4800 BCE increased marine influence and rising water levels led to replacement of alder carr by brackish reed communities, represented by a decline of *Alnus* and an associated increase of wild grass-type in the pollen diagram. Indicators for marine influence include hereby the element bromine in XRF analyses, pollen of Chenopodiaceae in the pollen diagram and records of foraminifera. From *c.* 4000 BCE the postglacial sea-level rise slowed down and barrier beaches and spits started to build up resulting in a gradually cut off of the Oldenburger Graben wetlands from the Baltic Sea (Jakobsen 2005).

According to the investigations at site LA 77, however, brackish to marine conditions prevailed during Middle Neolithic times, which is in agreement with diatom analyses from the neighbouring site LA 191, *c.* 200 m north of site LA 77 (König 1987). Rising water levels and declining marine influence between 3100–2700 BCE are indicated by changing sedimentation regimes in the investigated profiles, transition from peat to gyttja in SED35 and recommencing sediment accumulation at DAN 1, as well as by decreasing indicators for marine influence. From 2700 cal BC onwards records of *Sparganium*-type and *Pediastrum* suggest limnic conditions (Fig. 4, LPAZ 7). These results are well in agreement with the proposed age of 2900/2800 BCE for the marine limnic transition in the western lowlands of the Oldenburger Graben by Sönke Hartz and Gerd Hoffmann-Wieck (2000) and the postulated formation of barrier beaches with dunes at the western end of the Oldenburger Graben by Olaf Jakobsen (2005), which resulted in a cut off of the western fjord area from the Baltic Sea. From *c.* 1700 BCE onwards lower water levels are indicated by recommencing peat accumulation at location DAN1. This goes along with increasing evidence for marine conditions. Limnic deposits on top of this younger peat layer relate to the period of maximum sea levels following the latest major transgression phase at around 1000 BCE (Jakobsen 2005; Feeser and Dörfler 2019b).

Land use and local settlement activity

The palynological record reveals evidence for two phases of increased human activity, dating to between *c.* 3500–2800 and 2100–1700 BCE, respectively (Fig. 4, 5). These are characterised by elevated representation of anthropogenic indicators such as *Plantago lanceolata*-type, *P. major/media*-type, Cereal-type pollen and *Polygonum aviculare*-type (Fig. 4, LPAZ 5 and 8), indicating the presence of open disturbed ground and cereal cultivation/processing in the surrounding area. The first phase at least partly reflects the Middle Neolithic settlement of Oldenburg-Dannau LA 77. The palynological results, however, indicate an earlier start of anthropogenic activities already at around *c.* 3500 BCE. As there is no clear archaeological evidence from site LA 77 for local settlement activity during the Early Neolithic, the palynological record could also reflect the onset of settlement sites nearby. The nearest known Early Neolithic sites are located only *c.* 250 m northeast and southeast of LA 77. Maximum values for Cereal-type and *Polygonum aviculare*-type are found between *c.* 3200 and 3000 BCE and are well in

Oldenburg-Dannau LA 77

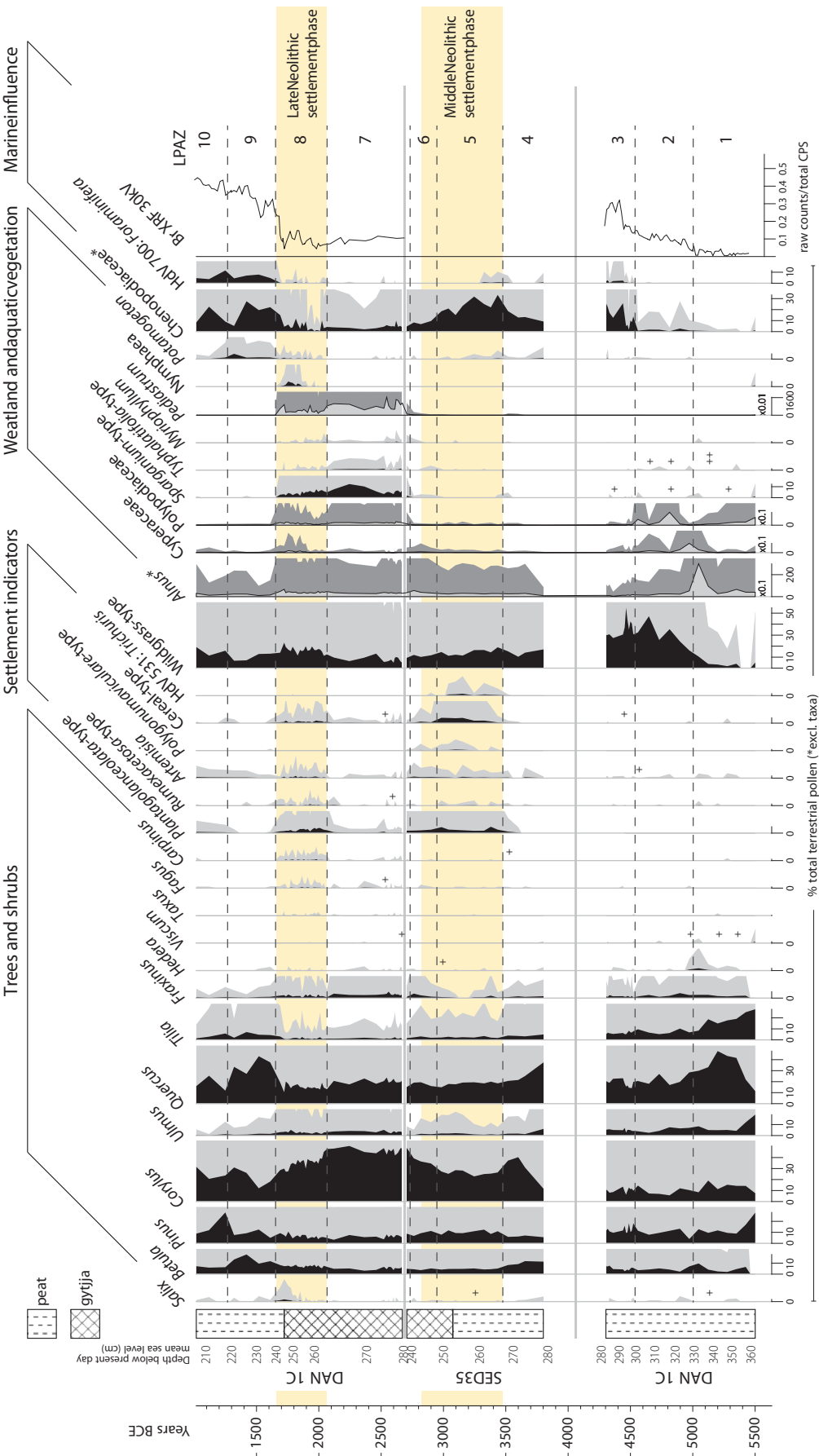


Fig. 4. Pollen diagram from Oldenburg-Dannau LA 77 combining the profiles DAN1 and -SED 35 and showing selected taxa and proxies for vegetation, land use and environmental changes. The derived two main phases of local settlement activities are highlighted (LPZ). Local pollen assemblage zones (modified from Feeser and Dörfler 2024; graphic: Ingo Feeser).

agreement with the archaeological defined main Middle Neolithic settlement phase. Noteworthy are the records of whipworm eggs (*Trichuris*, HdV-532). Whipworms live parasitically in the large intestine of various mammals (Brinkkemper and van Haaster 2012). The parasites are spread by the consumption of polluted water. The findings of *Trichuris* eggs in the settlement near deposits indicates increased faecal input in the nearshore areas and presences of potential host species, including both humans and animals, and therefore are interpreted to indicate increased local settlement activity. They probably also posed a health problem for the inhabitants since infection with whipworms leads to intestinal problems such as diarrhoea, and could even be lethal when untreated (Else *et al.* 2020). Interestingly, *Trichuris* remains are not found during the second Late Neolithic settlement phase.

Subsistence

Evidence from Site LA 77 suggest a typical Funnel Beaker economy with animal husbandry and plant cultivation but also hunting, fishing and gathering of wild plants (Brozio 2016; Kirleis 2019). Cereal processing within the settlement reflected by threshing remains (Brozio *et al.* 2014), food remains (Kubiak-Martens *et al.* 2024) and cereal-type pollen in on- and near-site pollen record (Brozio *et al.* 2014; Feeser and Dörfler 2019b). Direct evidence for cereal cultivation from the settlement site is lacking. But ard/plough marks at the neighbouring site LA 191 (Hoika 1982) and under a Middle Neolithic megalithic grave Wangels LA 69 (Brozio 2016; Feeser and Dörfler 2019a) c. 4 km southwest of the settlement indicate cereal cultivation from island/peninsula situations in the lowlands and further away from the upland areas. That cultivation probably involved mainly permanent agricultural fields in relatively dry areas is suggested by preliminary analyses of associated weed

assemblages (Filiopović *et al.* 2019). Additional nitrogen and carbon stable isotope analyses carried out within the same study, however, indicate that emmer and barley might have been grown on soils of different quality and moisture status. With emmer on somewhat drier conditions and more intensively managed fields. Palynological investigations at LA 69 support the existence of agricultural fields during late Early Neolithic times before the construction of the megalithic grave during the Middle Neolithic (Feeser and Dörfler 2019a). Two main cereal species Emmer (*Triticum dicoccon*) and naked barley (*Hordeum vulgare*) known from archaeobotanical studies including charred and food crust remains (Kirleis 2019; Kubiak-Martens *et al.* 2024). Also, palynologically evidence for two different types of cereals was found (Feeser and Dörfler 2019b). Their contribution to the diet — or, indirectly, flour impurity with stone residues during the grinding process — can be linked to the abrasion patterns of the teeth (cf. previous section).

Animal husbandry and hunting is documented by the bone assemblage from site LA 77, suggesting the dominance of cattle and pig (Brozio 2016). In the palynological investigated near-site profile (cf. SED35) coprophilous fungal spores — a proxy indicating the presence of large herbivores (van Asperen *et al.* 2021) — have only been sporadically found in settlement related deposits. This could suggest that cattle were not kept in settlement area or the dung has been collected. Indirect evidence for faeces presence in the settlement context is provided by the record of *Trichuris* (HdV 531) in the pollen diagram. Beside herbivores (e.g. cattle, sheep and goat), however, also human, pig and dog are potential host species (Brinkkemper and van Haaster 2012). The idea that cattle might have been kept outside the main settlement area would be in agreement with strontium isotope studies from Middle Neolithic sites in Southern Sweden, which indicate a high mobility of cattle but not so for pigs (Sjögren and Price 2013).

RITUALS, TAPHONOMY AND HUMAN REMAINS: THE OLDENBURGER GRABEN REGION AND THE SOUTHERN CIMBRIAN PENINSULA DURING THE NEOLITHIC

From the Middle to the Younger Neolithic, life in the region of the Oldenburger Graben has tremendously changed. During a period of c. 600 years significant transformations took place in nowadays Schleswig-Holstein and Northern Germany — in environmental, economic, demographic, technical and socio-ritual spheres. The following sections spotlight particular aspects with the aim of revealing the special significance of the Oldenburger Graben for the supra-regional context.

Human remains from the Oldenburger Graben – insights into Neolithic life and rituals?

As described in section 2, detailed analyses of human remains deliver unique insights into past life — even for the Neolithic times in Schleswig-Holstein, for which only few skeletal remains are preserved. However, reconstructing the formation of their deposition or the ritual background, its potentially underlying human actions and influence of taphonomic processes remains a complex task.

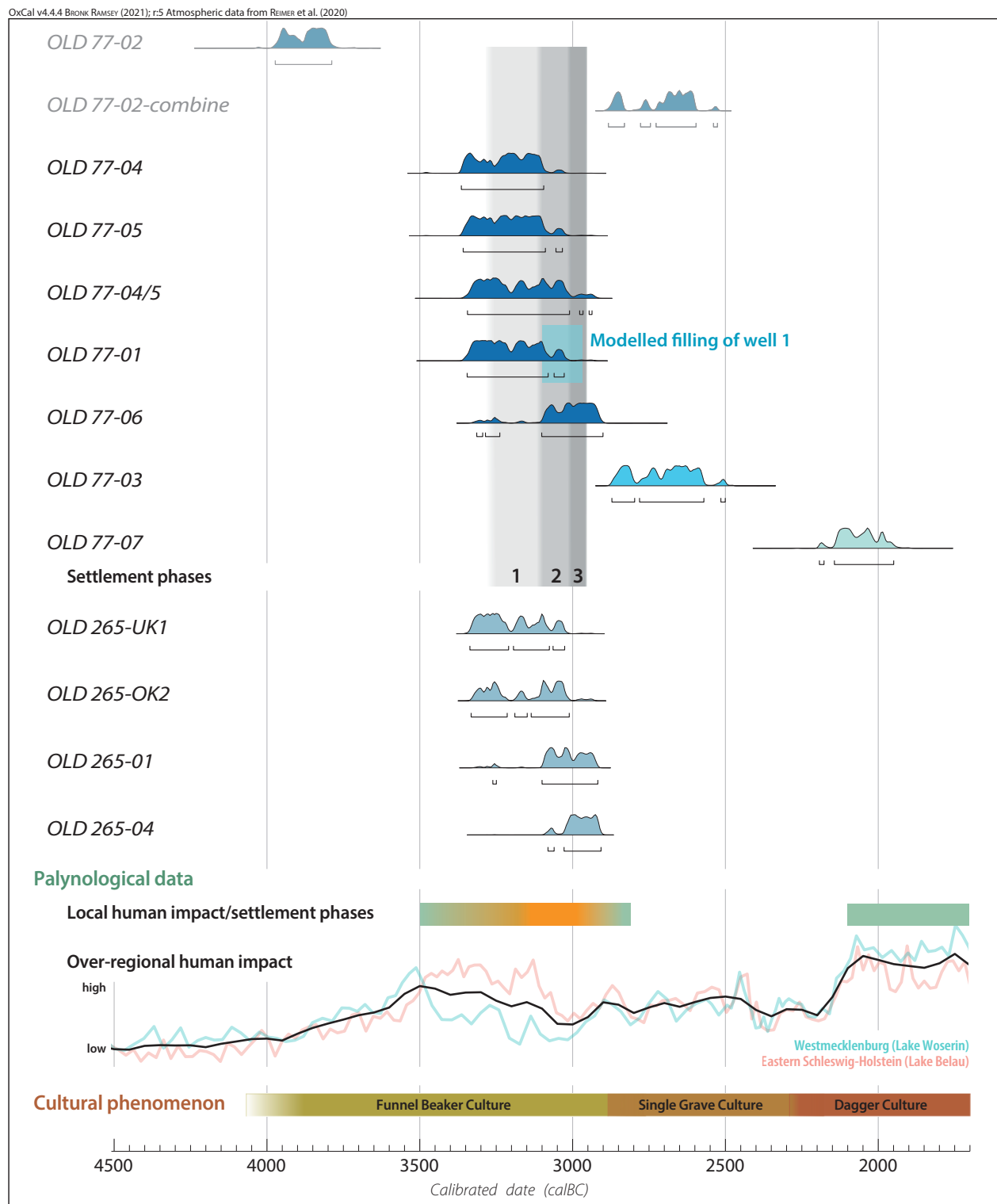


Fig. 5. Compilation of new and published radiocarbon dates of human bone samples recovered from Neolithic Oldenburg-Dannau LA 77 (OLD 77; see Table 1) and Oldenburg LA 265 (OLD 265, see Fuchs 2021) plotted together with as OLD 77 settlement phases and filling span of well 1 (Brozio et al. 2014). Added are indicators of socioeconomic and ritual transformations of the Middle and Late/Final Neolithic observed in local and over-regional (younger moraine area of northern Germany) palynological data (Feeser and Dörfler 2019b; Feeser et al. 2019) and cultural phenomenon (Graphic: Katharina Fuchs, Ingo Feeser).

At LA 77, all human remains dating between c. 3400 and 3000 BCE, which represent at least five individuals, add to the evidence of mortuary rituals connected to settlement contexts (see next subsection; Fig. 6). In this respect, the “case” of individual 1 is extraordinary due to the body position, the location between houses and the secondary disturbance. Although it remains unclear if those single bones found in the shore line stem from once complete skeletons of different Neolithic periods, which have been destroyed, washed away and displaced, a spatial proximity to the settlement is given. Since quite different types of bone have been found, a selectivity that could be associated with a ritual practice is not indicated. Furthermore, considering the size of the original settlement compared to the excavated area, it can be expected that more human skeletal material from the Funnel Beaker groups (and later periods) is still covered up. Thus, the mortuary behaviour of settlement depositions at this site might have had a greater extend, including males, females, elderly to subadults, than previously assumed. Secondly, the remains dating into the third millennium fill an often-observed gap of burial activity towards the transition to the Single Grave groups (SGC) as well as the Dagger period, regardless of if those Oldenburg-Dannau individuals 3 and 7 represent primary or disturbed burial contexts (Fig. 5).

The site Oldenburg in Holstein LA 265, which is located c. 3 km east from LA 77, has been excavated 2017 and 2018 in the course of an extensive archaeological endeavour prior for railway construction developments (Briel 2021). Similar to parts of LA 77, the excavated area covers the prehistoric shoreline of the Oldenburger Graben lowland. Discovered pottery remains and stone objects could be associated with the Funnel Beaker and SGC group cultural material, while radiocarbon dates suggest activity including the Bronze Age (*ibid.*). Amidst of numerous wooden remains, probably remains of a wooden trackway for crossing the swampy shores of the area here, 22 human bones have been recovered. The bones have been found in a layer of peat, admixed with gyttja and sand that marked the prehistoric shore area (*ibid.*). Preserved are various cranial fragments, remains of two upper and lower jaws with teeth, as well as two cervical vertebrae. All are, very similar to the remains of individual 3 from LA 77, in excellent preservation. The anatomical representation suggests at least five individuals, a juvenile, male and female individuals. These remains also provided insights into lifestyle and disease, quite similar to LA 77 (Fuchs 2021). Particularly distinctive and clearly different, however, is the selectivity of bone elements regarding the skull and the neck, which stays in contrast to LA 77. The mixed nature of the layer of alluvial gyttja, peat and sand as well

as the fact that the frontal and parietal bone of individual 1 were located in over 30 m distance from each other suggests turbulations of sediments and dislocations of contained material. Thus, floods that have washed away graves from the surrounding hills is a likely scenario (Briel 2021), and one could assume that especially the voluminous skulls were prone for dislocations by water force. Still, the only find of skull and neck bones in proximity to a wooden trackway makes a special kind of mortuary treatment, which obviously involved the marshy shores, appear possible. According to unmodeled radiocarbon dates their dead occurred most likely between 3200–3000 BCE (Table 1; Fig. 5), which coincides with dates obtained from two of the nearby wooden stakes (Fuchs 2021).

Clearly, solving the issue of the taphonomic and ritual processes that are behind the human bone finds from the Oldenburger Graben is a task for the future, which requires a diachronic approach. This is emphasized by other Neolithic finds such as Wangels LA 505 (Kloof 2008), the two bones from LA 77 evident for activities of the Iron Age, as well as a sacrum from LA 232 (Brozio 2019), which dates to the Medieval times (unpublished). For investigating burial rites during the Neolithic, human skeletal remains from settlements must be considered as well.

Ritual burial activities in Funnel Beaker domestic sites at the southern Cimbrian Peninsula and beyond

Findings of human bones in Neolithic settlement contexts, *i.e.* without typical features and grave goods of flat graves, is a widespread phenomenon in wetland situations. This seems to apply in particular for the area of the Oldenburger Graben where, beside at the already mentioned sites (LA 77 and LA 265), human bones were also documented in the cultural layer in the shore area of further sites Oldenburg LA 232 (Brozio *et al.* 2019a) and Wangels LA 505 (Kloof 2008). Furthermore, finds from other wetland sites in northern Germany human remains indicate a larger scale phenomenon. For example, several bones and a skull from the ditch system uncovered at Wolkenwehe (Hartz *et al.* 2007) or from the wetland site of Bistorf, LA 11, from which nine fragments of different bone types are preserved (Johansson 1979).

In Hunte 1, two skull masks with traces of wear on the inside and further human bones from a total of nine individuals were found, mainly in the former bank area (Kossian 2007). The bones showed various pathological changes, including trauma, inflammation, bone tumours, dental disease and arthritis. As there are no traces of cuts or predatory animal bites on the individual bones, it is possible on the one hand



Fig. 6. Map showing Funnel Beaker sites in Northern Germany with human remains from settlement and burial contexts (Graphic: Jan Piet Brozio; map: Karin Winter).

that they were carried away after an accidental excavation with subsequent natural or accidental burial, which can be attributed to unburied corpses, earth graves or mortuary displays. On the other hand, exhumations are also possible, as mentioned above in Oldenburg-Dannau, which led to partial burials of individual bones (Petrasch 2000).

Comparing the overall evidence various trajectories of human remains could be deduced from this. The distribution of individual human bones within settlements such as Oldenburg LA 77, Bad-Oldesloe-Wolkenwehe (Hartz *et al.* 2007) or Hunte 1 (Kossian 2007) in Lower Saxonia can therefore be attributed to taphonomic processes. These include the displacement of individual bones by a variety of processes and thus possibilities

such as animals, humans or natural processes such as erosion and flooding events. Regardless of this, special ways of handling the bones cannot be ruled out, as shown by the discovery of the bone from Oldenburg-Dannau LA 77 deposited in a well and, perhaps, by selectivity on skull bones apparent at Oldenburg in Holstein LA 265. The various features therefore reflect different practices with the deceased.

In contrast to the burial complexes, but also the shallow burial fields, the features interpreted as graves in the 4th millennium often have no or comparatively very few grave goods (Kossian 2005). This raises the question of what roles and attributions these individuals had in the societies. The collective burials, independent of age, gender and biological sex, suggest that several groups

used the megalithic tombs, which could only be erected by several people (Müller 2019). At the same time, the burial sites are located outside the settlements, which makes it possible to reconstruct a spatial separation. The people buried in the area of the settlements obviously do not belong to the group of people buried in megalithic graves, which raises the question of whether they had a different social position. The role of the monuments may certainly have been, among other functions, to commemorate common ancestors (Müller 2018), which would have excluded these people from this concept. This shows that we are not dealing with homogeneous rituals and practices (Brozio 2020). The few artefacts associated with burials are not remarkable in their character, as they are also found in the megalithic tombs, but they do not provide a picture of homogeneous ritual practices in burial contexts. The fact that these people were buried in the area of the settlements does not appear to have been a matter of taboo,

as they would most probably not have been buried in the area of everyday life. It is possible that the individuals were people who had a special relationship to the settlement and played a special role in it. For example, the oval stone packing features in Oldenburg-Dannau LA 77 (Fig. 1), which can be possibly reconstructed as graves like in Lavenstedt (Mennenga 2017), can be reconstructed as a symbolic boundary line separating the outside from the inside of the village community due to their alignment in a row and their location at the edge of the settlement. This is made even more significant by the fact that death was integrated into complex rituals through the megalithic tombs and grave goods, so that informal contact hardly seems possible. The Funnel Beaker burials in burial pits in the settlements could therefore also be secondary burials, in which the remains were deposited in megalithic graves after an earth burial, the complete skeletons or parts, such as skulls and long bones (Müller 2019).

ENVIRONMENTAL CHANGES, RITUAL STRATEGIES AND POPULATION DYNAMICS DURING THE 4TH TO 3RD MILLENNIUM BCE IN NORTHERN GERMANY

Changing landscapes

As the numerous archaeological sites suggest, the environment of the Oldenburger Graben has been an attractive settlement landscape since the end of the Mesolithic and throughout the Neolithic. Compared with situations further inland, the region offers a varied and diverse landscape with small-scale variation of terrestrial and aquatic resources and land-use potentials due to its transitional location between different natural areas (marine/limnic, aquatic/terrestrial). Natural environmental change due to sea level rise and coastal dynamics, however, also resulted in highly dynamic landscape (Hartz and Hoffmann-Wieck 2000; Hartz 1999) which influenced and affected local settlement activities (Feeser and Dörfler 2019b).

Furthermore, rising water levels in the Oldenburger Graben, due to transgression of the Baltic Sea, partly resulted in erosion of sediments, including natural peat and gyttja deposits but also cultural layers. This on one hand might result in hiatuses in sedimentary geo-archives used for palaeoecological reconstructions but on the other hand destroys archaeological stratigraphy and might result in re-located and mixed find assemblages (cf. also Hartz *et al.* 2011, 26). The palaeoenvironmental reconstructions at Oldenburg-Dannau LA 77 reveal evidence for erosion and reworking of older deposits due to rising water levels. The hiatus in profile DAN1 is spanning the time period 4300 to 2700 BCE and has been found in multiple corings from the surrounding lowlands. It is usually expressed by a sharp transition from

fen peat to gyttja (Feeser and Dörfler 2019b). The profile SED35, closer to the Middle Neolithic shoreline, provides evidence for a more gradual change from telmatic (peat) to limnic (gyttja) conditions at around 2900 BCE and suggests that rising water levels were responsible for the erosion and reworking of older deposits.

Human impact / population dynamics

The high number settlements from the Middle period (3300–2900 BCE), including the settlement site Oldenburg-Dannau LA 77, is of particular interest as it falls into the period for which the larger scale palynological pattern suggest declining and minimum human activity in the young moraine areas of northern Germany (Fig. 5). The over-regional patterns of human activity during the Funnel Beaker time in these regions can be summarized as follows. Maximum levels of human activity during Funnel Beaker times seem to have been generally reached earlier in the area of Western Mecklenburg, *i.e.* between *c.* 3600 and 3300 BCE. In the young moraine area of Schleswig-Holstein maximum values of anthropogenic indicators are generally observed between *c.* 3500 and 3150 BCE (Feeser and Dörfler 2015; Feeser *et al.* 2019). The general decline in human activity in the Mecklenburg area seems to have commenced already during the second half of the 4th millennium BCE, resulting in a lull of activity associated with a pronounced phase of woodland regeneration between 3200 and 2950 BCE.

In Schleswig-Holstein, however, evidence for human activity declines distinctly only after 3150/3100 BCE but also reaches a minimum at around 2950 BCE. Although woodlands also here seem to have partially recovered, elm values generally did not recover to the same extent as further east (Feeser and Dörfler 2015). In this respect the local developments recorded at site Oldenburg-Dannau LA 77 are diverging from the larger scale pattern. Here agreeing archaeological and palynological evidence dates the main settlement with the highest population numbers to the time between c. 3100 and 2900 BCE.

Complex rituals and new cultural impulses

In the world of the Funnel Beaker societies, megalithic tombs are of high importance as monuments in the landscape and evidence of the ritual significance of dealing with the deceased and an associated culture of memory. Therefore, changes in architecture point to dynamic processes in societies.

A change in the megalithic began around 3300 BCE with the rapid rise of passage graves in the Middle Neolithic, which were often built on or near moraine ridges and were intended for collective burials. In many cases, these feature subdivisions of the burial chamber, were used repeatedly over the centuries and indicate a collective identity within the communities. The Wangels LA 69 burial chamber (Brozio 2016), for example, is characterised by a division into three areas, including a quarter of upright stone slabs. In addition to stone artefacts and 69 amber objects, there is

an extensive ceramic inventory in the form of 57 vessels from the Funnel Beaker and Globular Amphora groups. High-quality grave goods, such as beef products, played an important role and indicate not only the importance of domestic cattle, which made up 90 % of the domestic animals in the settlements, but also the economic ability of individuals or groups to sacrifice these products. Overall, complex rituals emerge, which probably also served to communicate social norms and rules within the complicated and growing groups. In contrast to other parts of Schleswig-Holstein, the phenomenon of Globular Amphorae (Müller 2023), characterised by the eponymous vessel and necked comb axes and widespread from eastern to central Europe, is strongly represented in Ostholstein, where it is found above all in megalithic graves such as those in Wangels, Grammdorf or Neutestorf (all in the municipality of Wangels LA 69). The conspicuous vessel shape and decoration could possibly also be associated with a special content: for example, a spherical amphora from the Wangels LA 69 passage grave contained evidence of sea buckthorn oil (Weber *et al.* 2020).

From around 3200 BCE, an increase in weaponised artefacts such as hatchets, axes and arrowheads in ritual contexts can be seen and the construction of megalithic graves as collective burials comes to an end. Individual burials increased in number and population agglomerations can be observed, for example at Oldenburg-Dannau. From 3000 BCE onwards, people of the Globular Amphora Culture and the Single grave Culture (SGC) spread and replaced the Funnel Beaker groups in the investigated area, among other things noticeable in a clear decline in human impact on the landscape.

CONCLUSION

The Oldenburger Graben has attracted people since at least the Mesolithic period, as its diverse and overlapping landscapes of coastline, lagoons, islands, wetlands, rivers and forests in the hinterland (Knitter 2019a; 2019b) shaped a favourable area to live in. Its exceptional wetland conditions provide rich and at the same time rare archaeological material such as human bones, with the possibility to link them with on- and near-site palaeoenvironmental records — which makes it a favourable area for researching as well. However, the outstanding character of this region shows by the results.

Towards the end of the Funnel Beaker phenomenon, the settlement of Oldenburg-Dannau LA 77 gave rise to a way of life that differed significantly from the single farmsteads typical of the Early Neolithic in Northern Germany: the first villages emerged. At LA 77, archaeological and palaeoenvironmental

evidence suggest a local population development that reached its peak around 3100 BCE with a population of more than 100 people. Living was sustained by practising horticulture within and agriculture outside the settlement as well as stock breeding of cattle and pigs. From this densely inhabited settlement phase, skeletal remains provide a rare insight into how life was during that time — for instance that growing old was possible while dealing with common health issues.

Besides aspects of daily life, sites of the Oldenburger Graben as well provide food for thoughts of the ritual sphere during the Middle Neolithic, especially when considering a larger geographical context. Human remains from domestic sites of the Funnel Beaker group and beyond represent a ritual habit that seemed to be alternate to the regular practice of burying the deceased in communal megalithic tombs and the more seldom single graves. This indicates more diverse

socio-ritual practices, in which settlements played an important role. Here, different ways of handling the deceased becomes more evident, such as suggested by the femur of individual 1 deposited in the well, or possible activities targeted on the skull, as seen at LA 265. This diversity stays in contrast to the apparent uniformity in other cultural elements, such as the rite of collective burials in megalithic tombs or connecting attributes of pottery and stone artefacts.

With the changing landscape around 3000 BCE and the emergence of a lagoon environment, the settlement structure of the village began to disintegrate with the end of the Middle Neolithic. Both, lacking

settlement finds and palaeoenvironmental proxies suggest that in the following centuries the region was significantly less inhabited and that there was less interference with the landscape. However, the human remains found at LA 77 demonstrate that people still lived and died there, with evidence from the Single Grave and Dagger period.

As a conclusion, we have good reason to assume that the yet undiscovered finds — and those waiting in the archives — from the Oldenburger Graben and its surrounding hold great potential to further pursue these issues on an interdisciplinary basis.

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Mesolithikum trifft Neolithikum – Museumspädagogische Ansätze im Steinzeitpark Dithmarschen zwischen wissenschaftlichem Experiment und besucherorientiertem Angebot

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KEYWORDS: *transferring research results to the broader public, archaeological open-air museums, educational programs, experimental archaeology, Stone Age Park Dithmarschen*

Zusammenfassung

Der Steinzeitpark Dithmarschen in Albersdorf, Kreis Dithmarschen (Schleswig-Holstein), ist ein archäologisches Freilichtmuseum, in welchem die umgebende Landschaft integriert wird. Seit 1997 wurde das Parkgelände mit seinen neun archäologischen Denkmälern auf einer über 40 Hektar großen Fläche in Richtung einer „neolithischen“ Kulturlandschaft entwickelt. Der Steinzeitpark besteht aus originalen Strukturen, aber auch aus einer rekonstruierten, modellartigen Steinzeitsiedlung, die mit ihren Wohnplätzen zeitlich vom Mesolithikum über das Frühneolithikum bis zum Spät-

neolithikum reicht (das sog. „Steinzeitdorf“). Im März 2023 wurde das neue Museum „Steinzeithaus“ am Eingang zum Steinzeitpark eröffnet und bietet seitdem mit seinen originalen Funden neue Möglichkeiten der Kommunikation mit den Gästen. In diesem Artikel werden die über 20jährigen Erfahrungen und Probleme bei der Vermittlung aktueller Forschungsergebnisse an die breitere Öffentlichkeit durch verschiedene museumspädagogische Angebote beispielhaft vorgestellt und diskutiert.

Abstract

The Stone Age Park Dithmarschen in Albersdorf, in the county of Dithmarschen (Schleswig-Holstein, Germany), is an archaeological, open-air museum that integrates the surrounding landscape. Since 1997, the park has been developed into a “Neolithic” cultural landscape on a plot of land over 40 hectares large, with nine original archaeological monuments. The Stone Age Park consists of original, on-site structures, as well as a number of reconstructed, model-like Stone Age settlements from the Mesolithic period through the Early

Neolithic, the Middle Neolithic and the Late Neolithic period (“Stone Age village”). In the year 2023, the new museum “Stone Age House” has been opened at the entrance of the Stone Age Park and with its original findings enabling new possibilities of communication with the visitors. In this article, the experiences and problems in the mediation of the research results to a broader public via a broad range of educational programs over a period of more than 20 years are presented in examples and discussed.

EINFÜHRUNG

Seit 1997 arbeitet das Archäologisch-Ökologische Zentrum Albersdorf (AÖZA) daran, langfristig eine über 5.000 Jahre alte prähistorische Kulturlandschaft mit all ihren Charakteristika wie verschiedenen Landschafts-, Siedlungs- und Grabformen auf einer archäologisch sowie ökologisch vielfältigen Fläche von etwa 40 Hektar Größe so zu gestalten, dass der Besucher in diesem „Steinzeitpark Dithmarschen“ auf unmittelbare Weise in die Vergangenheit geführt wird (Kelm 2000; 2006).

Auf der Grundlage von mehreren wissenschaftlichen Tagungen in Albersdorf, die den aktuellen Forschungsstand zum jungsteinzeitlichen Hausbau, zur Entwicklung und Nutzung historischer Kulturlandschaften, zu prähistorischen Handwerkstechniken und weitere Themen behandelten, wurden dabei eine „Siedlung der letzten Jäger der Mittelsteinzeit“, eine „Siedlung der frühen jungsteinzeitlichen Bauern“ und weitere urgeschichtliche Kulturlandschaftselemente nachgebaut.



Abb. 1. Das „Steinzeitdorf“ im Steinzeitpark Dithmarschen in Albersdorf (Foto: Steinzeitpark Dithmarschen, Albersdorf).

DIE INFRASTRUKTUR – MODELLE ARCHÄOLOGISCHER SIEDLUNGSBEFUNDE

In den letzten 40 Jahren sind in Deutschland im Rahmen des Aufbaus verschiedener Archäologischer Parks eine ganze Reihe von Hausmodellen aus nahezu allen vor- und frühgeschichtlichen Epochen entstanden (Schmidt 2000). Von ganz besonderem Interesse sind hier die Häuser der ersten Bauern, insbesondere der Bandkeramik im Süden und der Trichterbecherkultur im Norden. Grundsätzlich sind dabei Fragen nach den vor über 4000 Jahren in der Jungsteinzeit vorhandenen Rohstoffen zu klären. Welche Werkzeug- und Holztechnologie stand zur Verfügung? Wie war das Dach konstruiert? Gibt es Hinweise auf Funktionszonen im Innenraum und außerhalb? Gab es Fenster oder Türen? Wer hat im Haus gelebt und wie hat man es genutzt?

Auf die meisten dieser Fragen kann der für die Rekonstruktion gewählte konkrete Ausgrabungsbefund allein keine Antwort geben. Andere Grabungsergebnisse und Funde ähnlicher Zeitstellung wurden beim Bau der Hausmodelle zu Rate gezogen, Beispiele aus der Völker- und Volkskunde (z. B. auch der Hausforschung) auf Hinweise untersucht, Ergebnisse archäologischer Hausexperimente in den Rekonstruktionsüberlegungen berücksichtigt.

Sicher datierte Hausgrundrisse der Trichterbecherkultur sind in Norddeutschland selten (Müller 2013). Die Häuser vom Typ Flögeln, die eine Grundlage für die Modelle im Steinzeitpark bilden, werden in die Zeit um 3200 v. Chr. datiert (Zimmermann 2000, 111); ein Gebäude vom Typ Flögeln war der erste Hausnachbau im Albersdorfer Steinzeitpark, der – wie bei den anderen Hausmodellen auch – jeweils zusammen mit den die Befunde bearbeitenden Wissenschaftlern geplant und realisiert wurde (Abb. 1).

Neben den Ausgrabungen in Flögeln, welche die Vorlage für die bisher beschriebenen Rekonstruktionsarbeiten darstellen, lieferten auch Untersuchungen der Bezirksarchäologie Lüneburg in Pennigbüttel, Stadt Osterholz-Scharmbeck, nördlich von Bremen sehr gut erhaltene Hausbefunde aus der Trichterbecherzeit (Assendorp 2002). Bei dem dort ausgegrabenen „Haus B“ handelt es sich wahrscheinlich um ein Wohn- und Betriebsgebäude, das im Laufe der Jahre 2001–2003 über einen Zeitraum von insg. acht Monaten ebenfalls in Albersdorf erbaut wurde.

Trotz aller Vorbehalte ermöglichen es die Ausgrabungsbefunde, ein grundlegendes Bild der damaligen



Abb. 2. Das mittelneolithische Hausmodell nach dem Befund von Pennigbüttel B, Niedersachsen. Seit 2020 wird der Eingangsbereich als museumspädagogische Station genutzt (Foto: Steinzeitpark Dithmarschen, Albersdorf).

Zeit zu entwerfen (ebd., 102–104). Solche Denkmodelle zwingen die Wissenschaftler einerseits zur Konkretisierung ihrer Ideen und zum Auffüllen bestehender Kenntnislücken, andererseits bieten sie ein hervorragendes Vehikel, den aktuellen Wissensstand einem interessierten Publikum zu vermitteln. Aus der trockenen Materie einer wissenschaftlichen Abhandlung entstehen Abbildungen, zumeist Zeichnungen, auf denen Häuser oder ganze Siedlungen in ihrer damaligen Umgebung dargestellt werden. Damit wird eine visualisierte Vorstellung der Vergangenheit geboten.

So stellt die in Albersdorf gewählte Hauskonstruktion nach dem Befund von Pennigbüttel B mit seinem schweren Dach aus Holzlaten und Grassoden eine Alternative zu den üblichen, meist mit Reetdach rekonstruierten Modellen dar und soll einen Diskussionsbeitrag zum Erscheinungsbild jungsteinzeitlicher Häuser leisten (Abb. 2). Sie ist einerseits Interpretation der beobachteten Eigenarten eines Ausgrabungsbefundes, andererseits greift sie Rekonstruktionszweifel an den einzelnen Konstruktionselementen auf. Und so wie niemand gezwungen ist, sich prähistorische Häuser immer gleichaussehend vorzustellen, so bietet das Modell in Albersdorf eine mögliche Bauausführung, die auf ihre Vor- und Nachteile in der praktischen Nutzung zu prüfen ist und durch die jahrelange museumspädagogische Nutzung praktisch getestet wird.

Der Nachbau des Hauses von Pennigbüttel B wurde ab dem Sommer 2004 als rekonstruiertes Wohnhaus der Steinzeit im Rahmen jährlich durchgeführter Seminare des Archäologischen Instituts der Universität Hamburg (Kelm und Meller 2021) mit einer zeit-

typischen Inneneinrichtung — bestehend aus „Lagerraum“, „Wohnraum“ mit Schlafstätten und Feuerstelle sowie weiteren Arbeitsräumen — versehen. Die Wände wurden teilweise mit Malereien und/oder Verzierungen in den Lehmwänden versehen. Dadurch soll ein Eindruck von den damaligen Lebensverhältnissen der ersten norddeutschen Bauern ermöglicht werden. Neben dieser experimentalarchäologischen Nutzung gibt es seit 2020 in diesem Haus auch das dauerhaft während der Öffnungszeiten angebotene Programm des „Steinzeitbauern“, wo mit Hilfe von Vorführ- und Mitmachaktionen das Leben und Arbeiten in der Jungsteinzeit demonstriert wird.

Es wurden neben den oben erwähnten Hausnachbauten nach den Befunden von Flögel und Pennigbüttel im Steinzeitpark Dithmarschen außerdem auch noch ein frühneolithisches Haus nach dem Befund von Rastorf, Kreis Plön (Steffens 2009; Diek 2014), ein spätneolithisches Haus vom Typ Flintbek (Zich 2000) und eine „Kulthütte vom Typ Tustrup“ (Becker 1993) vollständig aufgebaut.

Seit der Saison 2014 gibt es auch eine kleine „mesolithische Siedlung“ im Bereich eines kleinen Teiches, die aus mehreren vom Museumspädagogen Werner Pfeifer errichteten Reethütten besteht und wo die Lebens- und Wirtschaftsweise der letzten Jäger, Sammler und Fischer auf praktische Weise vorgestellt wird (Abb. 3). Damit soll trotz der grundsätzlichen zeitlichen Konzentration um den Abschnitt der Jungsteinzeit aber auch auf das Spektrum der archäologisch nachgewiesenen Bauformen und Bautechniken aus den Perioden vor und nach dem Neolithikum hingewiesen werden.



Abb. 3. Seit 2014 gibt es im Steinzeitpark Dithmarschen auch eine kleine „mesolithische“ Hüttensiedlung der letzten Jäger, Sammler und Fischer (Foto: Steinzeitpark Dithmarschen, Albersdorf).

Die Nutzung solcher Hausmodelle reicht inzwischen von der musealen Präsentation über die didaktische Vermittlung bis hin zur touristischen Nutzung – wie auch bei der Europäischen Route der Megalithkultur, die mit mittlerweile über 40 internationalen Mitgliedern (zu denen auch der Steinzeitpark Dithmarschen gehört) die urgeschichtlichen Megalithanlagen in den jeweiligen Regionen für einen nachhaltigen Tourismus anschaulich darstellt und die Forschungsergebnisse verständlich macht (LWL-Museum 2021).

Bei diesen publikumswirksamen-kulturtouristischen Darstellungen ist die Gefahr einer sehr einprägsamen und emotionalen Aufnahme des Dargestellten durch die Besucher als etwas „Originales“ immer vorhanden. Rekonstruktionsversuche, Hausmodelle und digitale Darstellungen bieten aber eine ideale populärwissenschaftliche Basis für die öffentliche Präsentation archäologischer Forschungen und erfreuen sich inzwischen eines großen Interesses.

DIE MUSEUMSPÄDAGOGIK – LEBEN IN DER STEINZEIT

Geschichte erleben und dadurch verstehen — das ist der grundsätzliche pädagogische Ansatz im Steinzeitpark Dithmarschen (Kelm 2006). Die Zeitspanne der ‚Neolithischen Revolution‘, der Zeit als aus Jägern, Sammlern und Fischern schließlich Ackerbauern und Viehzüchter wurden, bis zur Bronzezeit, als sich klar erkennbare soziale Hierarchien herausbildeten, wirkt in vielen Bereichen noch bis in unsere Zeit nach. Viele ökologische und gesellschaftliche Probleme, die wir heute erleben, haben ihren Ursprung genau in dieser

Zeit. Der Steinzeitpark will vor dem Selbstverständnis als seit 2007 zertifizierte Bildungseinrichtung für nachhaltige Entwicklung (BNE) das Leben und die Veränderungen dieser Zeit in allen Facetten dem Besucher erlebbar machen.

Seit dem Jahre 2015 wird deshalb im Albersdorfer Steinzeitpark ein für Norddeutschland bisher einmaliges Projekt durchgeführt: Das „Leben in der Mittelsteinzeit“ ist eine museumspädagogische Aktion, bei



Abb. 4. Zu den teils mehrwöchigen Aktionstagen „Leben im Mesolithikum“ beleben Museumspädagogen, Experimentalarchäologen und Archäotechniker das Gelände im Steinzeitpark (Foto: Steinzeitpark Dithmarschen, Albersdorf).

der bis zu 60 Akteure gleichzeitig die Lebens-, Wohn- und Ernährungsbedingungen in der Mittelsteinzeit zur Zeit der Ertebölle-Kultur um ca. 5.000 v. Chr. für eine Dauer von bis zu sechs Wochen praktisch austesten konnten. Die Aktion wurde in der im Jahr 2014 neu errichteten mittelsteinzeitlichen Hüttensiedlung mit angrenzendem Teich und Waldbereich im Steinzeitpark Dithmarschen unter Leitung des „Steinzeitjägers“ (und Museumspädagogen) Werner Pfeifer geplant, vorbereitet und durchgeführt (Abb. 4). Neben der fotografischen und filmischen Dokumentation, fanden während der Aktion viele begleitende Führungen und spezielle Programme statt (Pfeifer 2019).

Aufgrund der Vielzahl neuer Forschungsergebnisse zur Mittelsteinzeit in Norddeutschland und wegen der langjährigen Erfahrungen des Steinzeitparks Dithmarschen als BNE-Einrichtung konnte eine möglichst authentische Durchführung garantiert werden. Durch die Kooperation mit mehreren anderen archäologischen Freilichtmuseen in Europa im Rahmen des Projektes „OpenArch“ (www.openarch.eu) wurden auch

internationale Teilnehmer aus Dänemark, England, Italien, Finnland und Norwegen als Experimentalarchäologen mit einbezogen. Die wissenschaftliche Begleitung erfolgte dabei durch das auf Experimentelle Archäologie spezialisierte Archäologische Institut der Universität Exeter aus England. Auf diese Weise konnten nun verschiedene Teilbereiche des prähistorischen Lebens wie z.B. Jagen, Fischen, Essenszubereitung, Wohnen, Kleidung, Gesundheit und Körperpflege dargestellt werden (Kelm 2015). Die in diesen Wochen gewonnenen tiefen Eindrücke und besonderen Erlebnisse werden alle Beteiligten noch lange bewegen und im besten Sinne nachhaltig wirken, ebenso auch bei den Museumsbesuchern, wie die Auswertung entsprechender Befragungen ergab.

Für einen verkürzten Zeitraum von jeweils bis zu zwei Wochen wird dieses Projekt seit dem Jahr 2016 in internationaler Zusammenarbeit und mit jeweils wissenschaftlicher Begleitung auch in den kommenden Jahren weitergeführt werden.



Abb. 5. Das neue Museum „Steinzeithaus“ begrüßt am Eingangsbereich des Steinzeitparks die Gäste mit einer Architektur, die durch die an den Außenwänden befestigten Holzbalken an die Hausbauformen der Jungsteinzeit erinnert (Foto: Steinzeitpark Dithmarschen, Albersdorf).

DAS STEINZEITHAUS – ORIGINALE IM MUSEUM

Anfang des Jahres 2023 hat das neue Museumsgebäude am Eingang des Albersdorfer Steinzeitparks seinen Betrieb aufgenommen (Abb. 5). Der Steinzeitpark hat durch dieses Museumsgebäude eine wesentliche Ergänzung erfahren, vor allem auch in Blick auf die vielfältigen Möglichkeiten der neuen (museumspädagogischen) Verbindung zwischen Innen- und Außenbereich.

Das Museum besteht aus zwei Hauptbauteilen, dem Ausstellungsbereich und dem Verwaltungstrakt. Die architektonische Idee ist dabei von den steinzeitlichen Vorbildern im Steinzeitdorf inspiriert, einmal sind es die kantige Form und die graue Farbe des Gebäudes, die an das Material „Feuerstein“ erinnert, und dann auch die Form des Pultdaches im Ausstellungsteil, das von außen ein Grasdach aufweist und im Inneren klar an die Bauweise der Steinzeithäuser mit entsprechenden tragenden Holzbalken erinnert.

Die Aufgabe der Dauerausstellung ist es, den Besuchern auf anschauliche Weise einen Einblick in die unterschiedlichen Epochen der Steinzeit in der Region, aber auch in ganz Schleswig-Holstein zu geben. Das Leitthema ist dabei die Wechselwirkung zwischen Menschen und Umwelt, die sich über die jeweils sehr unterschiedlichen Klimaverhältnisse und Vegetationsformen in den beschriebenen Epochen besonders intensiv erzählen lässt. Die wichtigsten Zielgruppen der Ausstellung sind Schulklassen, Familien mit Kindern sowie sogenannte *Best Ager* (oft mit ihren Enkelkindern). Die Dauerausstellung im Steinzeithaus versteht

sich als Teil einer größeren Attraktion mit dem Außengelände, zu der auch das Steinzeitdorf gehört. Dort können die Besucher in die „Lebendige Archäologie“ der Mittel- und Jungsteinzeit eintauchen. Das „Steinzeitdorf“ bietet eine ganz andere Form des Erlebens als eine auf originalen Funden basierende Ausstellung im Innenbereich. Idealerweise ergänzen sich die beiden Ausstellungsteile im Betrieb und in der Wahrnehmung durch die Gäste zu einem Gesamterlebnis: Die Ausstellung im Museum bietet die Originalfunde, das Dorf erzeugt durch maßstabsgetreue Nachbildungen einen Eindruck davon, wie das Leben ausgesehen haben könnte.

Um diesen Unterschied stärker herauszuarbeiten, ist es sinnvoll, den Originalen in der Ausstellung soweit wie möglich und didaktisch passend den Vorzug zu geben und ihre Einzigartigkeit stärker hervorzuheben. Wenn Repliken zum Einsatz kommen, werden sie visuell deutlich unterschieden.

Wie in mehreren Workshops und Gesprächen z. B. ginn des Planungsprozesses herausgearbeitet, so ist die Vorstellung der meisten Menschen von der Steinzeit eher verschwommen. Neben Klischees wie Höhlen als Wohnung und Keulen als Jagdwaffen sorgt auch die Terminologie und die Abfolge der unterschiedlichen Epochen für Verwirrung. War die Jungsteinzeit vor der Altsteinzeit? Wann lebten die Dinosaurier, wann die Mammuts? Die übliche auf der Geburt Christi basierende Zeitrechnung macht das Erfassen der Zeiträume noch schwieriger.



Abb. 6. Die Ausstellung im Steinzeithaus ist in ihren Abteilungen nach den steinzeitlichen Epochen gegliedert, die sich auch in der farblichen Darstellung absetzen. Hier ein Blick in die Jungsteinzeit mit der Farbe gelb, die den Bezug zu Getreidefeldern herstellt (Foto: Steinzeitpark Dithmarschen, Albersdorf).

Die Abfolge der Epochen und die dazugehörigen Zeiträume sind deshalb ein wichtiges Vermittlungsziel der Ausstellung, da sie die Grundlage für das weitere Verständnis bildet: Die Wechselwirkung zwischen Mensch und Umwelt. Erst wenn die Besucher verstanden haben, in welcher Abfolge und in welchen zeitlichen Dimensionen klimatische Veränderungen in der Vergangenheit stattfanden, können sie verstehen, was das für die Zukunft bedeuten mag.

Die Gleichzeitigkeit anderer Entwicklungsstufen in anderen Weltregionen bleibt dabei nicht unerwähnt, tritt aber deutlich in den Hintergrund. Diese Konzentration sorgt dafür, dass wir uns nicht in der möglichen Themenvielfalt verzetteln und „im Kopf der Gäste“ Klarheit schaffen. Dies ermöglicht uns auch, an wichtigen Punkten stärker in die Tiefe zu gehen.

Bei der Konzeption haben wir uns intensiv mit dem Verhältnis von Steinzeitdorf und Dauerausstellung auseinandergesetzt und uns gefragt: „Was kann das Steinzeitdorf besser?“ „Was kann die Ausstellung besser?“ Die Antwort lautete: Das Steinzeitdorf ermöglicht das

„Eintauchen in die Zeit“. Die Nachbildungen sind lebenssecht und maßstabsgetreu, man bewegt sich räumlich durch die Welt der Steinzeitmenschen; Gerüche und natürliche Umgebung spielen eine wichtige Rolle.

Die neue Ausstellung kann dagegen zeitliche Abfolgen und Zusammenhänge besser darstellen und sie anhand von Originalen erklären (Abb. 6). Und — ihre größte Stärke — sie kann die Besucher mit Hilfe der Forschung auf eine spannende Expedition in die Vergangenheit schicken. Dabei kann sie einen Einblick in sehr unterschiedliche Forschungsmethoden bieten, wie z. B. Ausgrabungen, Datierungsmethoden, experimentelle Archäologie, Botanik oder Genanalyse.

Die Ausstellung im Steinzeithaus erzählt dabei die Geschichte der Dithmarscher Landschaft und der Menschen, die sie bewohnten und in und von ihr lebten. Der Bogen reicht von den Neandertalern bis zum Beginn der Bronzezeit. Dabei bleibt die Ausstellung möglichst eng an den Funden aus der Region und benutzt sie, um aufzuzeigen, wie sich das Wissen über unsere Vorfahren wie bei einem Puzzle mal zu einem Gesamtbild

zusammenfügt, mal auch lückenhaft bleiben muss. Wo aufgrund der Fundlage nötig, erweitert sich der Fokus auf andere Regionen in Schleswig-Holstein.

Die Ausstellung hat drei Protagonisten: Die Umwelt, die Menschen der vergangenen Zeiten und die Forschenden, die Informationen über Menschen und Umwelt zusammentragen.

Im Foyer gibt das Lackprofil vom Fundplatz Schalkholz bereits eine kurze Einführung: Auf beeindruckende Weise zeigt es die langen Zeiträume, von denen die Ausstellung handelt und auch, was die Erde heute noch über Klima und Landschaft verrät. Die Neudatierung der neandertalerzeitlichen Fundsicht auf die Zeit vor ca. 100.000 Jahren ist dabei nicht nur didaktisch hilfreich, sondern auch inhaltlich von größter Bedeutung, da es sich mit diesem Fundplatz und seinen Artefakten tatsächlich um den frühesten sicheren Nachweis menschlicher Besiedlung in Schleswig-Holstein handelt (Clausen *et al.* 2020).

Die Besucher gehen vom Foyer dann die Treppe hinunter — wie im Lackprofil „zurück in der Zeit“. Unten angekommen können sie sich entweder nach rechts wenden und dem Pfeil „Was bisher geschah“ folgen. Der Raum dort, das „Forschungszimmer“, zeigt den fiktiven Arbeitsplatz mehrerer Forschender. Zum einen bietet es eine Einführung in die moderne archäologische

Forschung, zum anderen bietet es auch eine kurze Einführung zur Geschichte des Homo Sapiens und der Fundgeschichte in Schleswig-Holstein.

Gehen die Besucher dann nach links, kommen sie in den Hauptteil der Ausstellung. Dieser ist mit Wänden in drei offene Räume unterteilt: Altsteinzeit, Mittelsteinzeit sowie Jungsteinzeit bis Bronzezeit. Der Rundgang ist chronologisch gemeint, die Ausstellung kann aber auch intuitiv erschlossen werden. Der Rundgang endet an der Treppe mit einem Ausblick auf die Bronzezeit und einer partizipativen Station, die weiter in die Gegenwart und Zukunft verweist. Von hier führt die Treppe hinauf in den Sonderausstellungsbereich oder eine Abkürzung zurück zum Fahrstuhl.

Durch das neue Steinzeithaus erhält nicht nur der Steinzeitpark Dithmarschen mit dem „Steinzeitdorf“ als archäologischem Freilichtmuseum eine wesentliche Erweiterung und Verbesserung der Attraktivität für seine Gäste, auch die räumlichen und praktischen Grundlagen der museumspädagogischen Vermittlungsarbeit stellen sich nun viel umfassender dar und helfen zukünftig dabei, über die Forschungsergebnisse der Kolleginnen und Kollegen an den Universitäten und in der archäologischen Denkmalpflege gut verständlich, anschaulich und für den Laien interessant zu informieren.

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von großer Bedeutung waren. Die jahrelange Tätigkeit von Johannes Müller in den Wissenschaftlichen Beiräten für den Steinzeitpark als auch für die Europäische Route der Megalithkultur seien hier besonders hervorgehoben.

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Sacred Waters

The Role of Depositions in Water During the Danish Neolithic Illustrated by Two Examples

Lutz Klassen, Torsten Madsen

KEYWORDS: Wet area depositions, North European Neolithic, Funnel Beaker Culture, Single Grave Culture, rituals

Abstract

Ritual deposition of objects in water is widespread during the Danish Neolithic. The type of objects varies in time through the roughly 2000-year-long period, while the nature of the deposits seems more stable. For the most part, individual objects, often of high value, have been deposited at selected locations in either fresh or salt water.

This article presents two examples of such locations. One is a narrow strait that connected the inner part of Horsens Fjord with its outer parts. During the Stone Age, the location was characterised by violent tidal

currents. The other location is a long narrow bog area on the northern part of the Djursland Peninsula.

The astonishing number of objects that have been collected over the years from the two areas and their connection with the contemporary surrounding societies of the Danish Neolithic are described and discussed, with a focus on the very special physical conditions that characterise the two locations. Finally, an interpretation of the cultural background of the deposits and their significance for the Neolithic local communities is presented.

Zusammenfassung

Die rituelle Deponierung von Objekten in Gewässern ist im dänischen Neolithikum weit verbreitet. Während sich die Art der deponierten Objekte im Laufe der etwa 2000 Jahre langen Periode ändert, ist der Charakter der Deponierungen selbst relativ einheitlich. In der Mehrzahl der Fälle handelt es sich um Niederlegungen ausgesuchter Objekte oft großen Wertes an ausgewählten Orten mit Süß- oder Salzwasser.

Der Beitrag präsentiert zwei Beispiele für solche Orte. Das eine ist eine schmale Meerenge, die den inneren mit dem äußeren Teil des Horsens Fjord in Ostjütland miteinander verband. Die Meerenge war durch sehr starke Gezeitenströmungen gekennzeichnet. Das

zweite Beispiel ist ein schmales, heute vermoortes Tal im Nordosten der Halbinsel Djursland, ebenfalls im östlichen Jütland.

Die erstaunliche Zahl der an diesen Orten im Laufe der Jahre entdeckten Objekte und deren Beziehung zu den neolithischen Gesellschaften wird beschrieben und diskutiert. Das Hauptgewicht wird dabei auf die sehr speziellen naturräumlichen Bedingungen, die beide Orte kennzeichnen, gelegt. Abschließend wird eine Deutung des kulturellen Hintergrundes der Deponierungen und deren Bedeutung für die neolithischen Gesellschaften präsentiert.

INTRODUCTION

Sacrifices in lakes and bogs are a fundamental element of the Funnel Beaker Culture, from its beginnings around 4000 BCE and afterwards (Becker 1948; Rech 1979, 35–62; Karsten 1994, 63–92; Koch 1998, 15). The depositions continue through the later parts of the

Neolithic, mainly in the form of flint axes and battle axes (Rech 1979, 62–68; Skaarup 1985, 385, 395), and in both the Bronze Age and Iron Age sacrifices in bogs and lakes are a significant phenomenon (Jensen 1979, 61; Hvass 1980, 99–101).



Fig. 1. The location of the Horsens Fjord and Veggerslev river valley areas in Jutland (Map: Ea Rasmussen).

The background of the extensive and continuous offerings is likely to be associated with the dominant role of bogs and lakes in the South Scandinavian landscape. When the ice retreated after the last Ice Age, it left behind numerous, scattered wetlands, which were

impassable in many places (Madsen 2024, 18 fig. 2.7). This can be hard to imagine today, when drainage has totally altered the landscape, but the general importance of wetlands in South Scandinavia is, for example, clearly reflected by popular beliefs in the Middle

Ages, which persisted until recent times. Evil spirits, both male and female, could be found in such areas – magical beings such as trolls, and bog women who left a veil of mist over the lakes when they brewed alcoholic beverages (Koch 1998, 168–69).

The Central European cultures that provided the starting point for the Neolithisation of the South Scandinavian area, cannot have been the source of the sacrificial customs in the wetlands, as the natural environment in these regions was very different and no definite parallels can be identified. The customs must instead have arisen locally, perhaps with their roots in the Ertebølle Culture (Karsten 1994, 166–70). This is difficult to confirm, however, as the settlements of the Ertebølle Culture are located near the edges of the

same wetlands where the potential sacrificial finds have been recovered. But in the case of some finds of high-quality objects, the circumstances of their recovery indicate that these must have been sacrifices (Hartz *et al.* 2011, 56–7).

In the following, using two examples, we will attempt to shed light on some of the aspects associated with offerings in wetlands during the Neolithic, as well as the problems involved in interpreting them. One is Horsens Fjord in eastern Jutland, and especially the narrow Stensballe Sund, which connects the main fjord with a smaller, inner part. The second example is a long, narrow valley south of Veggerslev in the northern part of Djursland, a peninsula on the east coast of Jutland (Fig. 1).

HORSENS FJORD

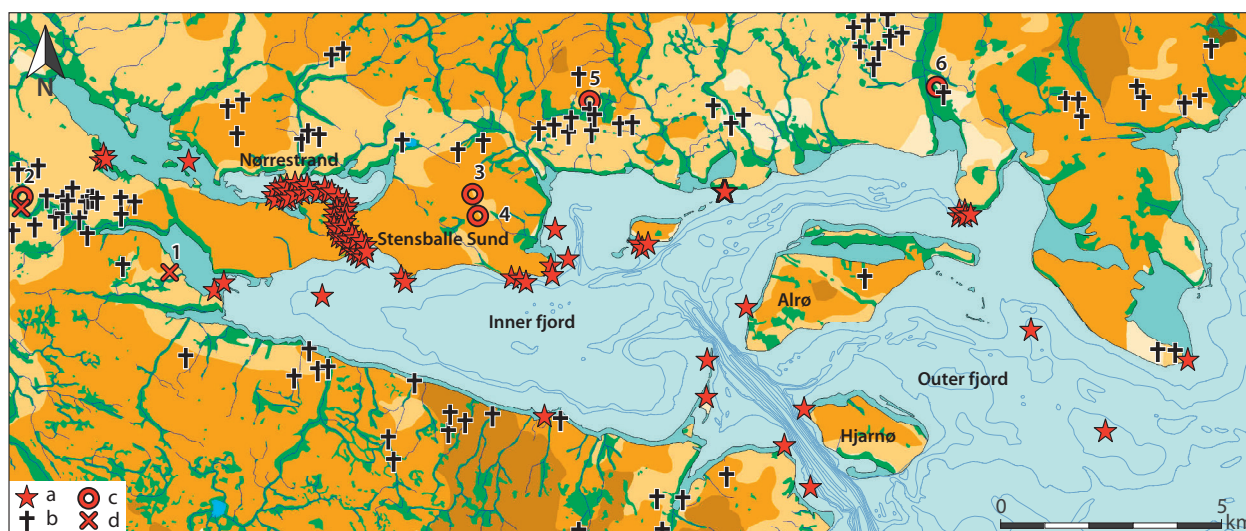


Fig. 2. Map of Horsens Fjord showing the greatest extent of the sea in the Neolithic (dark blue) and as it is today (light blue). The colours, from white-yellow to brown, indicate the composition of the soil in the following sequence: coarse sand, sand, clayey sand and sandy clay; green: wetlands on maps dating to the early 19th century; a object deposited in seawater; b megalithic tomb; c causewayed enclosure; d hoard containing copper. The following sites are marked with numbers: 1 Bygholm; 2 Aarupgård; 3 Bjerggård; 4 Guldbjerg; 5 Toftum; 6 Aalstrup (Graphic: Torsten Madsen).

Horsens Fjord is c. 20km long and 7km wide at its mouth. Two large islands — Alrø and Hjørnø — with very shallow areas in between, however, mean the fjord is only accessible via a narrow strait (Fig. 2). This is only around 400m wide in places and is at most 22m deep. The outer fjord E-SE of Alrø covers an area of 30km², whilst the inner fjord west of there covers 46km². A 1.2km-long and 150–200m-wide sound — Stensballe Sund — connects the innermost part of the fjord with Nørrestrand, an area of seawater covering 1.4km², which after a dam and locks were constructed above the sound in 1915 became a freshwater lake.

Based on mapping of rises in sea level and land up-lift after the end of the Ice Age, the highest sea level in the Horsens Fjord area, recorded as 1.0 and 1.4 m above present sea level, should have been reached around the transition between the Mesolithic and Neolithic (Christensen and Nielsen 2008, 36–38). However, the coastal settlements of the Ertebølle Culture in the fjord are c. 1 m below today's sea level (Skriver, Astrup and Borup 2018, 11), and the highest sea level was probably reached either in the Late Neolithic or Late Bronze Age (Madsen 2024, 26 fig. 2.15). This is because neotectonic activities deep beneath the fjord have created

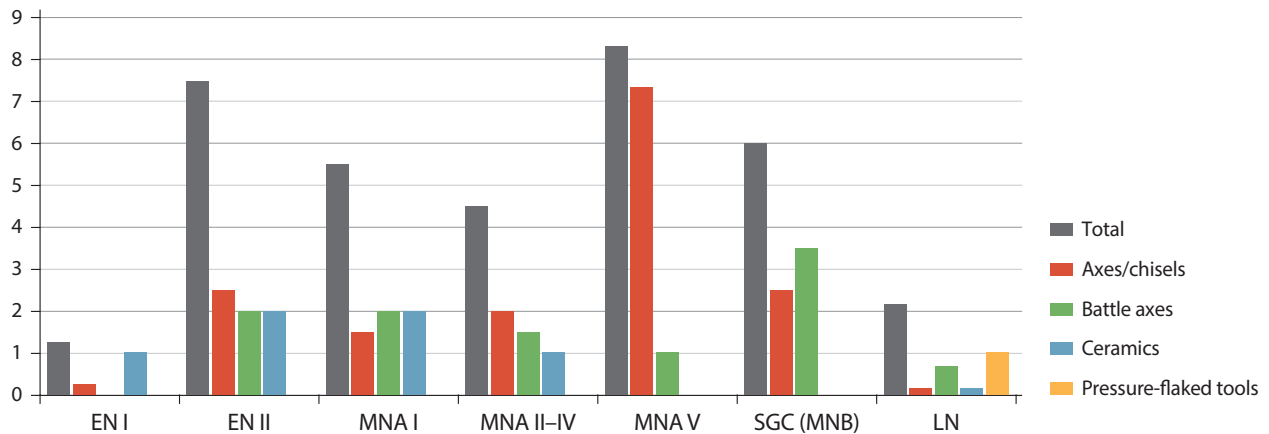


Fig. 3. The occurrence of flint axes/chisels, battle axes, pottery and pressure-flaked flint from Horsens Fjord, divided into seven phases of the Neolithic. The vertical axis shows the number of objects per hundred years within each of the phases.

a depression, that is around 3 m deep, during the last 8,000 years (Lykke-Andersen 1979, 4).

The inner part of the fjord has changed significantly since the Neolithic when it extended a further 5 km inland behind Nørrestrand and was up to 2 km wide (Fig. 2). Today, the area is covered by freshwater sediments and peat, but boreholes have indicated the presence of underlying marine deposits that are 13 m deep (Borup 2003, 274 fig. 3). During the Neolithic, Nørrestrand covered c. 6.2 km², which is five times larger than its current size. The distance between low and high tide in the fjord was also different. It is 0.3 m today, whilst in the Neolithic it was around 0.5 m. This is because at that time there were open waters between the North Sea and the Kattegat in the Limfjord area in North Jutland, but also because the currents in the North Sea were different (Conradsen and Heier-Nielsen 1995).

In normal tidal conditions, 15 million m³ of water pass in and out of the fjord to the south of Alrø and Hjarnø four times a day, producing significant currents. In the Neolithic, when the volume of water was near 25 million m³, the currents must have been extremely strong, and the same would have applied to Stensballe Sund. Only around 4 million m³ of water would have passed through the sound, but the formation of massive, natural banks of oyster shells meant that it was probably only 2–3 m deep. With this depth, the water would have flowed through the sound at a speed of around 20–30 km per hour.

Between 1938 and 1967, the shell banks were dug up and used to produce calcium supplements for chicken feed. The top of the banks lay a few metres below the surface and the layers were up to 15 m thick in places (Lomholt 2003). When the shells were dug up, large quantities of antiquities were found. Some originated from Ertebølle settlements along the shore, but most

were objects that had been deposited in the sound. More than 300 archaeological artefacts have been recorded, mainly dating to the Neolithic, but also the Bronze Age and Iron Age (Lomholt 2003). These only represent a fraction of the total number of finds, however, as significant numbers of objects were apparently sold to private collectors. Today, there are 70 preserved objects from the digging up of the shells which can be categorised according to type and dated to the Neolithic. The objects from Stensballe Sund and Nørrestrand are not the only examples of depositions from the Neolithic period in Horsens Fjord. Another 35 objects can be attributed to depositions in the fjord: 13 from the outer fjord, 18 from the inner fjord and 4 from the now drained area west of Nørrestrand (Fig. 2).

The extensive depositions in Horsens Fjord are unique, but are not the only examples of depositions in seawater. At Kølholm, in Roskilde Fjord, south of Frederikssund, Zealand, finds were also made when shells were dug up in the 1950s and 60s, but unfortunately little information is available about these and only a few objects ended up in museum collections (Davidsen 1983; Koch 1998, 268–270). Similar circumstances surround a material recovered from the Lammefjord, northern Zealand (Koch 1998, 299–300), and there are also finds from Svendborgsund, between Funen and Tåsinge, which are probably from depositions (Skaarup 1985, 81–82). Most striking, however, is a thin-necked flint axe with a preserved haft, which had been pushed down into the seabed at Syltholm on the south coast of Lolland (Jensen *et al.* 2018, 45).

The objects from Horsens Fjord date to the whole Neolithic period, with most dating to EN II and MNA V (Fig. 3, for an explanation of the abbreviations see table 1). Pottery, axes and battle axes are evenly distributed throughout EN II and MNA I, after

Table 1. Overview of the chronological division and occurrence of cultural groups in the study area.

BCE	Chronological phases	Horsens Fjord	Veggerslev Mose
4000–	Mesolithic	Ertebølle Cultur	Ertebølle Cultur
3800–	Early Neolithic I	Funnel Beaker Culture	Funnel Beaker Culture
3600–			
3400–	Early Neolithic II		
	Middle Neolithic A I		
3200–	Middle Neolithic A II–IV		
3000–	Middle Neolithic A V		Pitted Ware Culture
2800–	Middle Neolithic B I		
2600–	Middle Neolithic B II	Single Grave Culture	Single Grave Culture
2400–	Mid. Neolithic B III		
2200–	Late Neolithic I	Late Neolithic Culture	Late Neolithic Culture
2000–			
1800–	Late Neolithic II		

which the pottery is phased out, at the same time as the axes reach an absolute zenith. During the Single Grave Culture (MNB), there is a decline in the numbers of axes, whilst the battle axes reach the peak of their distribution curve. In the Late Neolithic, the numbers of all three categories decrease at the same

THE VEGGERSLEV VALLEY

The Veggerslev valley is one of several valleys that cut through the moraine plateau of North Djursland in a north-south direction (Fig. 4). Its formation and character have been described by Stig Schack Pedersen and Kaj Strand Petersen (1997, 15), and Uffe Rasmussen (2020, 142–143), which the following summary is based upon.

Stig Schack Pedersen and Kaj Strand Petersen use the term Veggerslev lineament for the valley in order to emphasise that it was formed by a deeper-lying tectonic fissure. Today, the valley extends in a c. 6 km-long straight course from Veggerslev in the north to the holm of Kainsbakke in the south, from where it continues in a curved course to Kolindsund, which

time as pressure-flaked flint tools appear. The deposits in Horsens Fjord thus clearly represent a fixed ritual practice throughout the whole of the Neolithic.

In the East Jutland area, there was scattered settlement during EN I, with each settlement probably only containing a single family. In EN II, relocation to the coast occurred, where clusters of large settlements were established; these were probably based on lineages and clans consisting of several lineages (Madsen 2024, 462). The formation of settlement clusters is clearly reflected by the grouping of megalithic tombs from EN II and MNA I along the fjord, together with the distribution of causewayed enclosures (Fig. 2), five of which have been recorded: Aarupgård, Bjerggård, Guldbjerg, Toftum and Aalstrup. The two neighbouring sites of Guldbjerg and Bjerggård, dated to respectively early EN II and late EN II-early MNA I, probably superseded one another.

Both megalithic tombs and causewayed enclosures were ritual structures that were associated with an important social aspect. The construction of megalithic tombs and the deposition of pottery in front of these reflects intense competition between lineages and clans for influence and power (Madsen 2019; Madsen 2024, 463). The cluster of megalithic tombs associated with Aarupgård is by far the most obvious in Horsens Fjord, which is further emphasised by the fact that both of the well-known copper finds from Bygholm and Aarupgård came from here (Fig. 2; Klassen 2000, 351–53). The concentrated settlement which appeared in the inner part of the fjord during EN II resulted in considerable competition for power and influence, not only internally but also with other groups, either leading to the elimination of competitors using violence, or alliances forged by exchange and marriage (Madsen 2024, 390).

was a fjord during the Atlantic and Early Subboreal. From a watershed at Emmelevvase Bro to the south of Emmelev, the valley is drained by two watercourses, both of which are minor brooks: Veggerslev Å to the north and Villersø Bæk to the south. The southernmost part between Kainsbakke and Kolindsund is drained by Skærvad Å.

Marine sediments in a large area north-east of the mouth of the valley at Veggerslev and toward the Gjerild bay on the present Kattegat coast, as well as limited remains immediately north of Kainsbakke holm, indicate that at one point the Stone Age sea flowed through the valley, which was therefore an arm of the sea (see Schack Pedersen and Strand Petersen 1997, 74).

With reference to geological investigations conducted by Jørgen Troels-Smith (1942, 162–166) in connection with the investigation of the Dyrholmen settlement from the Ertebølle Culture, Uffe Rasmussen (2020, 143) proposes that the highest water level in the valley corresponded with the Subboreal transgression around 3000 BCE. According to Charlie Christensen and Anne Nielsen (2008, 36–38), however, it is more likely that the highest water level and thus the sea flow in the Veggerslev valley was associated with the Late Atlantic transgression at the end of the Ertebølle Culture, late in the 5th millennium BCE. At this time, the mouth of the valley at Veggerslev led out into a smaller, branched inlet, which was connected to the Kattegat to the north-east (Rasmussen 2020, 144 fig. 2). The highest water level in the area reached around 5.5 m above the current sea level. The decreasing sea level combined with land uplift subsequently resulted in the sea receding from the valley itself, which gradually became a bog area. The mouth area at Veggerslev and out towards the Kattegat, on the other hand, was probably part of the sea throughout large parts of the Neolithic. At high tide and with a strong north-easterly wind, the sea must also have flowed into the valley, certainly in the earliest part of the period. The circumstances of the finds of Neolithic depositions, which began to be placed around 3700 BCE, however, indicate that most of the valley had by this time already become a bog area and it was therefore not possible to sail from its mouth at Veggerslev to the Kainsbakke holm. Whilst the depositions at the mouth of the valley at Veggerslev may thus have been placed in seawater or brackish water, those further to the south must be regarded as bog depositions.

From the around 6 km-long and 300–400 m-wide stretch of valley between Veggerslev and the Kainsbakke holm, as well as the bogs around the latter, 60 different depositions containing around 140 objects have been recovered. Most of these were discovered during road work around 1900 and peat digging in the second half of the 1940s. Many of the finds are unpublished and are today often also missing, although some of those dating to the Funnel Beaker Culture are listed by Jakob Vedsted (1986, 110–114, Fundliste C). In the surrounding parts of north-eastern Djursland, a number of depositions have also been discovered in both bogs and the sea, but the Veggerslev valley has a very significant concentration (Fig. 4). The vast majority (54) of the depositions from the valley can be placed in the period between *c.* 3700 and 3100 BCE, *i.e.* the Funnel Beaker Culture in late EN I, EN II and MNA I–II (see table 1). This corresponds to nine depositions per century. The timespan is characterised by the production of thin-butted flint axes, which are also clearly the dominant object type amongst the finds. Strikingly, only two

of the finds can be dated to the late part of Middle Neolithic A/beginning of MN B (3100–2850/2600 BCE), corresponding to 0.4 finds per century. After this, a few more (four) finds from the Single Grave Culture between 2600 and 2350 BCE are again recorded, including the remarkable amphora from Veggerslev (Becker 1948, 58–60, fig. 14), although this could also date to the previous phase (Hübner 2005, 304–310). The finds frequency is therefore 1.2–1.6 finds per century. It is worth noting that north of Veggerslev, outside the river valley itself, in the area that was an inlet during parts of the Neolithic, two extensive hoards from the Single Grave Culture have been recovered: 13 flint axes from Benzon Enge (Ebbesen 1983, 154 fig. 28) and 108 amber beads from Skideneng near Veggerslev (unpublished, East Jutland Museum j.nr. DJM3158). In the Late Neolithic (2350–1700 BCE), the river valley seems to have completely lost its special ritual significance. Not a single deposition dating to this period has been recorded.

Throughout the period, the depositions are dominated by flint axes. The deposits, which solely consist of one or more flint axes or axe blanks, thus constitute 44 of the 54 depositions from EN and MN A I–II. In addition, there are five more finds in which flint axes or axe blanks are found together with other object types. Amongst these, one or more depositions solely consisting of flint axes are very probably concealed, as the objects may have been deposited over a long period of time in the same place, but have been mixed together when they were recovered.

Flint axes continue to dominate the finds until the depositions cease, with only the aforementioned pottery vessel from the Single Grave Culture interrupting this pattern. Other object types from the early deposition phase include pottery (at least four depositions containing a total of 13 pottery vessels/collections of sherds) and tools made of stone (two depositions with the same number of objects, including a tanged club). In addition, a pair of horns from an aurochs were found in the bog around Kainsbakke; these have been ¹⁴C dated to 3350–3100 BCE (unpublished). The depositions may also have included humans/human bones, as there is a skull from Rimsø, although this is not dated (unpublished).

During the construction of a road dam across the valley near its mouth at Veggerslev, in 1893, remains of a wooden platform were found, and around this, at the same stratigraphic level, 13 different objects from the Funnel Beaker Culture: five flint axes, one flint chisel and fragments of seven pottery vessels (Becker 1948, 53–58). The structure can be interpreted as a sacrificial platform, which only has a few parallels within the South Scandinavian Funnel Beaker Culture (Salpetermosen on Zealand: Koch 1998, 143, and perhaps Alvasstra in West Sweden: Browall 2011; 2016).

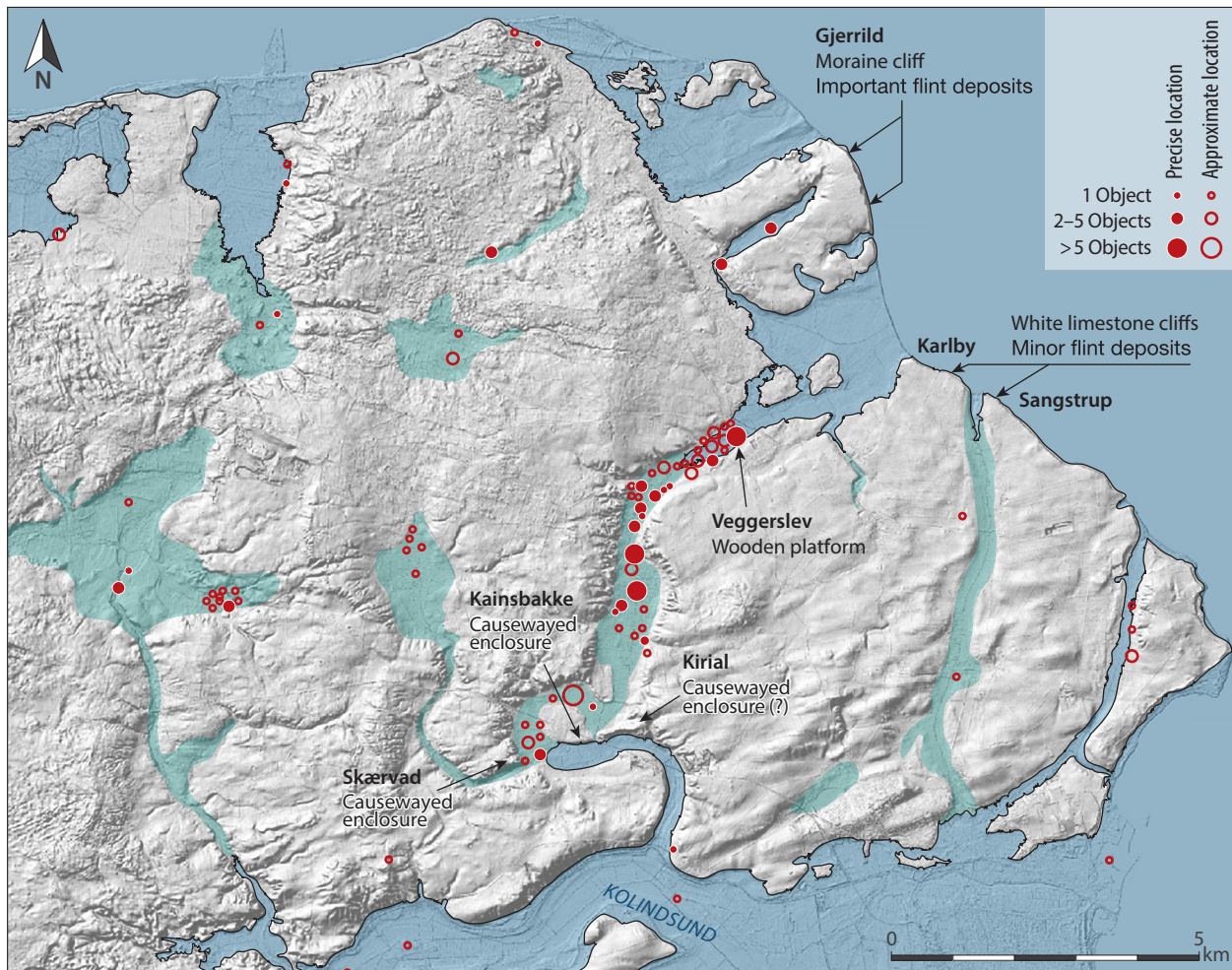


Fig. 4. North-eastern Djursland showing the Veggervslev valley and depositions within it. Only Funnel Beaker Culture depositions dated between 3,700 and 3,100 BC are included. Other significant Funnel Beaker Culture sites and important cliffs with flint deposits are also shown (adapted from Klassen *et al.* 2020).

Whilst the number of depositions in the river valley during the Funnel Beaker Culture (3700–3100 BCE) is remarkable, the deposition custom itself overall fully corresponds with that found in this culture's entire distribution area. The almost complete cessation of the depositions in the subsequent period up until *c.* 2600 BCE is, however, striking, as this period is generally characterised by continuity in relation to the depositions, as is demonstrated, for example, at Horsens Fjord (Fig. 3) and on Langeland (Skaarup 1985, 407–408). The explanation for this is probably related to the emergence of the Pitted Ware Culture in Djursland, where the population adopted a different ideology characterised by animism of North-East European origin. The Kainsbakke site, with its extraordinary traces of shamanic rituals, is by far the most significant find of this kind (Klassen *et al.* 2020, 455–464). Even though the type of ritual activities thus changed character to a

considerable degree, at least parts of the river valley retained their central, ritual importance throughout the whole period. After the end of the Pitted Ware Culture, there was a minor renaissance of the depositional traditions of the Funnel Beaker Culture, during the Single Grave Culture up until 2350 BCE, although this was accompanied by a considerable reduction in the number of finds. The picture therefore corresponds to that which is generally characteristic of the Single Grave Culture in central and eastern parts of Denmark (Rech 1979, 62–66 map 2). The complete absence of depositions in the Late Neolithic is more difficult to explain, as it has been demonstrated that the area continued to be of major importance with the flint deposits being exploited, especially in the first part of the period, based on finds including Bell Beaker pottery (Klassen *et al.* 2020, 476 fig. 12).

DISCUSSION

When superficially considered, the deposits in wetlands appear to merely consist of axes and/or pottery, deposited either individually or in groups of several objects. In relation to the axes, it can also be noted that axes deposited individually are often heavily worn, whereas when several axes are found together, these are often unused and of high quality (Koch 1998, 159). A corresponding difference in the quality of the axes can also be observed in the deposits from the Veggerslev valley and Stensballe Sund. The flint axes that are completely dominant at Veggerslev almost entirely consist of worn examples, typically only 15–20 cm long, as well as a number of axe blanks. The situation is very different at Stensballe Sund, where the flint axes are generally of high quality, and are also supplemented by a large number of very high-quality battle axes (Madsen 2024, 208 fig. 7.4). From Horsens Fjord there are 10 battle axes and four clubheads from the Funnel Beaker Culture, nine of which are from Stensballe Sund and two from the fjord immediately next to the sound. In an overview of the battle axes of the Funnel Beaker Culture, Milan Zapotocky (1992, 223–366) mentions nine examples found in seawater, although none of those from Horsens Fjord are included. The finds from there have thus more than doubled the known number of battle axes from the Funnel Beaker Culture in South Scandinavia which have been deposited in seawater.

The finds from both Stensballe Sund and the Veggerslev valley are, however, hindered by the problem that they in reality should be regarded as stray finds. Apart from the wooden platform at Veggerslev, we have no concrete knowledge of the character of the depositions, so in order to establish a clearer background picture, it is necessary to examine the deposits that have more detailed information about the circumstances of their discovery. The deposits involving a combination of human bones, animal bones and antiquities are important in this respect. The human bones originate from several individuals and often include cranial fragments. The animal bones are mainly from domesticated animals, especially cattle, with in several cases ox skulls with fractures indicating that the animals had been killed by a blow to the forehead, such as at Gammellung Mose on Langeland (Skaarup 1985, 71–72 fig. 36). The deposited finds typically consist of pottery vessels and flint axes, but in some cases also pottery and flint characteristic of settlements, such as in the bog Myrbjerg Mose on Langeland, where the deposition, which includes human bones, is covered by a layer of stones (Skaarup 1985, 76–77). A number of the human skull fragments from this type of deposition exhibit damage caused by blows (Bennike 1999). Furthermore, a study of bone from megalithic tombs

indicates that 14.6% of 378 skulls were affected by injuries, a third of which had not healed (Fibiger *et al.* 2013, 195, tabl. 9).

Apart from a stray find of a skull from Stensballe Sund, which has been ¹⁴C dated to the late Funnel Beaker Culture, and possibly the undated skull from Rimsø mentioned above, no human bones have been recorded, and in only one case can animal bones be associated with the finds. Therefore, at least some of the depositions could be of this kind, but both the density and quantity of finds in Stensballe Sund and the Veggerslev valley mean it is unlikely the deposits generally belonged to this category.

Other documented types of deposits included objects, primarily pottery, placed in holes dug into springs (Rasmussen and Skousen 2012), as well as a special and probably not especially common form of deposition of humans, who were very probably executed and their bodies deposited in a complete state. Well documented examples include a woman from Falbygden in the northern part of South Sweden (Sjögren *et al.* 2017), a woman from Sigersdal Mose in North Zealand (Bennike and Ebbesen 1987) and a man from Boelskilde on Als (Bennike, Ebbesen and Jørgensen 1986). The first mentioned lay in the water with her hands tied behind her back, whilst the other two were found with a cord around the neck and had presumably been strangled. Neither of these two types of deposition, however, correspond with the finds from Stensballe Sund and the Veggerslev valley.

We must also assume that one or more objects could be deposited together, without these being involved in complex associations with other types of material. Such depositions are, however, extremely difficult to record, as this requires systematic excavation of the area surrounding the deposition. The finds from Stensballe Sund in particular, with the numerous prestigious objects, could though very well be of this type.

Crucial questions, of course, are for whom and why were deposits placed in the bogs? As mentioned in the introduction, in historical times, wetlands have been regarded as the habitats of powerful beings. Similar notions must also have existed in the Neolithic, albeit with a somewhat different background to that of the Christian societies. Agrarian communities of the type we are examining in this article are typically characterised by worship of ancestors. This is fundamentally based on the idea that humans have both a physical and spiritual soul. The latter is released when a person dies and moves on to a new world, which is typically located underground. From here, it can interact with the physical world and is determining factor for those living there. It is therefore important to remain on good

terms with one's ancestors, which in the case of the Funnel Beaker Culture, is reflected, for example, by the extensive rituals that were associated with tombs and causewayed enclosures (Madsen 2024, 384–389).

Can the deposits in water also be interpreted as part of the ritual activities associated with worship of ancestors? In the depositions in which, in addition to axes and pottery, human bones, animal bones and objects typical of settlements are included, this must have been associated with a completely different background to that of the causewayed enclosures. The included human bones can hardly have come from their own clan or tribe, but more likely from 'strangers', with whom there was a hostile relationship. The rituals may therefore have been a celebration of a victorious clash with enemies in a conflict, in which the depositions were a way of presenting and sharing the result with the ancestors. It is, however, far from certain that the deposits were only intended for the ancestors. They may equally well have been intended for mythical deities, which were thought to control the world order, and either lived in the water or used it as a passage up to the surface of the earth.

If we turn to Stensballe Sund, however, the depositions can hardly only have marked victory over enemies; they are far too extensive for this. Moreover, many of the flint axes and especially the battle axes are perfect, unused examples, with some of which, as already mentioned, amongst the finest preserved examples. The deposits must in general be related to the unique character of the sound. The strong tidal current, which would have resembled a rapidly flowing river with white foam, and changed direction every six hours, would have been a terrifying sight. The large white banks of oysters immediately below the surface of the water must also have been of great significance.

In this connection, it is not merely coincidental that oyster shells have been found in the causewayed enclosures at Guldbjerg, Toftum and Aalstrup, the first two of which are located 1 km from the nearest coast. Many shells are present at Toftum in particular, but there are no traces of shells in the waste layers at the contemporary settlement immediately to the east of the enclosure (Madsen 2024, 337–43). Shells have been recovered from 13 of the 41 causewayed enclosures of the Funnel Beaker Culture's northern group, and with just one exception all of these are located in North Jutland and the central part of East Jutland, with a marked concentration in Djursland (Madsen 2024, 350 figs. 11.70). Their occurrence in deposits at these sites is very obviously of ritual significance (Klassen and Knoche 2019, 87–89).

Another aspect that the particular conditions in Stensballe Sund may have been important to, is the creation of the centre of exchange and power that became

established in the inner part of Horsens Fjord, and which, for instance, is reflected by the hoards of copper at Bygholm and Aarupgård. The presence of a deity, as the evidence from Stensballe Sund indicates, may have led to the location becoming a 'place of pilgrimage' and there was thus much interest in entering into alliance-forming exchange connections with the group that controlled the sound.

In the case of the Veggerslev valley, there are also clear indications that this area must have had a special ritual status to the Funnel Beaker Culture. To the south, the valley ends at the Kainsbakke holm, as well as at the Skærvad promontory to the west and the Kirial isthmus with the Fuglhøj mound to the east of Kainsbakke. It is noteworthy that causewayed enclosures have been found in all three areas and that these enclosures are located in a 2 km-long, straight course. This demarcated the bog areas around the Kainsbakke holm and in the Veggerslev valley to the north from the arm of the sea to the south (Klassen *et al.* 2020, 468–472). The course constitutes a kind of symbolic boundary between the busy fjord south of the holm, where no depositions have been recorded, and an area which, in the Funnel Beaker Culture, was reserved for the ancestors and deities on the Kainsbakke holm and the river valley to the north of there. The sacrificial platform at Veggerslev, which may have been part of a larger construction across the river valley, constitutes an obvious northern boundary of this sacred area in the Funnel Beaker Culture. Therefore, not a single deposition from the Funnel Beaker Culture has been recorded in the broad inlet north/north-east of the structure.

During the Pitted Ware Culture period, beliefs changed with the emergence of this culture's ideology, as described above. The Kainsbakke holm was transformed into one of the largest settlements of the Danish Neolithic, and also had a special ritual function, whilst at the same time the placing of deposits in the river valley more or less ceased. As mentioned above, the depositions were to a limited extent resumed in the Single Grave Culture, but it is worth noting that the large hoard containing flint axes from Benzon Enge and the amber find from Skideneng both originate from the open inlet at the mouth of the river valley north-east of the Veggerslev wooden platform, and therefore outside the area which was delimited as being of ritual importance during the Funnel Beaker period.

The sacrifices in the Veggerslev valley and Stensballe Sund, as already described, share many general similarities, especially their enormous extent and geographical delimitation in narrow sounds or valleys of special ritual importance, but in terms of the character of the sacrificed objects, they differ greatly from one another. Whilst the deposits in Stensballe Sund include a large number of battle axes and other stone



Fig. 5. The limestone cliffs at Sangstrup (foreground) and Karlby. Note the cortex-covered dark flint nodules embedded in the limestone in the bottom left of the picture (Photo: Mogens Bo Henriksen).

tools of often excellent quality and high prestige value, this type of object is, apart from one exception, absent in the Veggerslev valley. The dominant flint axes here almost exclusively consist of small, used examples, which are everyday rather than prestige objects. The frequency of the flint axes can be linked to the important flint deposits in Gjerrild Klint, as well as Karlby and Sangstrup Klint at the mouth of the river valley. This impression is reinforced by a number of axe blanks amongst the finds. Sites are also known at the mouth of the river valley, where flint from the cliffs has been worked on an almost industrial scale from the Ertebølle Culture onwards (Neden Skiden Enge: Rasmussen 2020, 173–194).

Despite these differences, Stensballe Sund and the Veggerslev valley seem to be related, as both are characterised by extremely large numbers of wetland deposits, and both must have been places of great ritual importance, with only a few parallels in the Danish Neolithic. Aamosen (Koch 1998, 305–367) can be

mentioned in this connection, although it is of a different character, both in terms of geography and finds. It is therefore particularly interesting that the special ritual significance of the Veggerslev valley can probably be attributed to the limestone cliffs at Karlby and Sangstrup (Fig. 5). These cliffs would have been visible from a considerable distance at sea and, with their white colour, must have attracted the population of a large area, perhaps extending all the way to West Sweden on the other side of the Kattegat. Nor is it coincidental that all three causewayed enclosures at the bottom of the Veggerslev valley are characterised by extensive deposits of white shells of oysters and various mussels. It is therefore probably the special, white natural phenomena, combined with other particular aspects, such as the flow of water in Stensballe Sund and the unusual topography of the Kainsbakken holm, which gave the two areas their great ritual significance and therefore explain the very large concentrations of offerings in both places.

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Pioneers on the North Sea Coast

North Holland Saltmarsh Occupation in the 4th and 3rd Millennium BCE

Jos Kleijne

KEYWORDS: Neolithic, West Friesland, transformations, soil micromorphology, settlement

Abstract

This paper reviews the evidence for the occupation of the saltmarsh wetlands of North Holland (the Netherlands) during the 4th and 3rd millennia BCE. We critically re-examine the large-scale transformation processes around 2800 BCE in this small-scale study area. Several settlements dating to the first half of the 3rd millennium BCE have been excavated, and some of these are well-known to an international audience. They are situated on levees and show a mixed subsistence strategy — of both crop cultivation and animal husbandry as well as the use of the rich natural resources of the saltmarsh landscape — and functional differences between temporary camps, year-round occupation, and more permanent long-term settlements. Culturally, these communities are clearly associated with the Corded Ware phenomenon. Importantly, funerary customs show a mixture of traditional and novel elements, whereas ceramics and stone artefacts

clearly show wider connections. Earlier occupation of the saltmarshes in the 4th millennium BCE is far less understood. It is primarily known from several small-scale settlements, located on low levees. Recent micromorphological analysis suggests a recurring presence in this still very wet landscape, potentially as temporary camps. Additional finds, such as a wooden canoe and several flint and stone axe heads, point to an already intensive use of natural resources during this period. Culturally, these communities are associated with the Funnel Beaker west group, although the Vlaardingen group is also present in this landscape, indicating less defined borders and complex relations. Summarised, we see a continuous occupation of this landscape between 3200 BCE and 2400 BCE. All in all, the evidence from this wetland landscape can show us a nuanced interpretation of this transformative period in Europe.

Zusammenfassung

In diesem Artikel werden die Besiedlungsspuren in den Salzwiesen von Nord-Holland (Niederlande) während des 4. und 3. Jahrtausend v. Chr. untersucht. Ziel ist die Erforschung der großen Transformationsprozesse um 2800 v. Chr. in diesem kleinräumigen Untersuchungsraum. Mehrere Siedlungen der ersten Hälfte des 3. Jahrtausends v. Chr. wurden gegraben, einige sind publiziert und einem internationalen Publikum wohl bekannt. Sie liegen auf den natürlichen Uferwällen und weisen eine gemischte Subsistenzstrategie von Ackerbau, Viehsucht, und die Nutzung der natürlichen Ressourcen der reichen Salzwiesenlandschaft auf. Funktionale Unterschiede sind deutlich, zwischen temporären Lagern, ganzjähriger Besiedlung und dauerhafteren Langzeitsiedlungen erkennbar. Kulturell sind diese Gemeinschaften eindeutig mit dem Phänomen

der Schnurkeramik verbunden. Bemerkenswert ist, dass die Bestattungsbräuche eine Mischung aus traditionellen und neuen Elementen aufweisen, Keramik- und Steinartefakte dagegen deutlich weitreichende Verbindungen erkennen lassen.

Über die frühere Besiedlung des 4. Jahrtausend v. Chr. ist weitaus weniger bekannt. Sie besteht aus verschiedenen kleinen Siedlungen, auf den niedrigen Uferwällen der Salzwiesen. Neuere mikromorphologische Analysen deuten auf eine wiederkehrende Präsenz in dieser noch immer sehr feuchten Landschaft hin, möglicherweise in Form temporärer Lager. Weitere Funde wie ein Einbaum und mehrere Feuerstein- und Steinbeile belegen bereits in dieser Zeit eine intensive Nutzung der natürlichen Ressourcen. Kulturell sind diese Gemeinschaften mit der Trichterbecher-West-Gruppe verbunden,

aber Belege der Vlaardingen-Gruppe in dieser Landschaft deuten auf weniger klare Grenzen und komplizierte Beziehungen hin. Zusammenfassend wird eine durchgehende Besiedlung dieser Landschaft zwischen

3200 und 2400 v. Chr. sichtbar. Insgesamt können uns die Funde aus diesem Niederungsgebiet eine differenzierte Interpretation dieser transformativen Phase in Europa liefern.

INTRODUCTION

The Dutch North Sea coast harbours one of the best studied prehistoric wetland landscapes in Europe. Archaeological assemblages here are often characterised by their good preservation conditions for bone and charred organic macroremains, and high degree of intactness, both effects of millennia of sediment buildup and the reducing groundwater conditions. This consists of, for example, Mesolithic/early Neolithic habitation on Pleistocene sandy outcrops, donken in the Rhine/Meuse delta (Louwe Kooijmans 1976; Amkreutz 2013), early Neolithic occupation on the freshwater riverine levees in the IJssel/Vecht valley (Raemaekers and De Roever 2020), middle Neolithic occupation on

sandy coastal dune ridges (Louwe Kooijmans and Jongste, 2006), and middle to late Neolithic occupation in the saltmarsh landscape of North-Holland (Kleijne *et al.* 2016). Specifically the properties of this saltmarsh landscape allow for a clear understanding of the impact of major European-wide transformations around 2800 BCE on local communities and their practices. Herein lies the focus of this paper, as a homage to the exceptional work of Johannes Müller in this regard. We will first introduce the landscape, review the occupation during the 4th millennium BCE, and finally disentangle the transformation process taking place around 2800 BCE.

LANDSCAPE AND OCCUPATION



Fig. 1. The location of all the findspots mentioned in the text.

This saltmarsh landscape, is the focus of this paper (Fig. 1 and 2). This specific landscape, and the North Sea coast in general, developed during the Holocene as a consequence of postglacial sea-level rise and fluvial development. From c. 4000 BCE onwards, sediment transport from the major rivers Rhine and Meuse outpaces the (decreasing) rise in sea-level, creating a westward prograding coastline for the first time. Firstly, a beach barrier coast formed, with a large tidal lagoon behind it. In the subsequent phase, these barriers increased in size and extent, simultaneously creating tidal basins in their wake. In these tidal basins, marine gullies and creeks with sandy levees and cheniers (Westerhoff *et al.* 1987) developed, a saltmarsh landscape. Behind these levees, a backswamp area developed where fresh water was available, and eventually peat started developing. During the Bronze Age, these saltmarshes became more stable environments, the gullies silted up along the coast and became freshwater streams, and the levees drowned when peat growth continued (Van Zijverden 2017; Vos *et al.* 2018).

When discussing the Neolithic occupation of this saltmarsh landscape, most attention is focused on the

settlement pattern from 2800 BCE onwards. Small seasonal extraction camps, such as at Keinsmerbrug (Smit *et al.* 2012), single household year-round occupation sites, such as at Mienakker (Kleijne *et al.* 2013), and large multi household year-round occupation sites, such as at Zeewijk (Theunissen *et al.* 2014), and at other large sites such as Kolhorn (Van der Waals 1989) and Aartswoud (Gehasse 2001).

Less known are several other settlements in this saltmarsh landscape, predating this Late Neolithic occupation. These sites are Bouwlust and Kreukelhof, near Slootdorp in the Wieringermeer Polder (municipality of Hollands Kroon; (Hogestijn and Drenth 2000). Radiocarbon dating clearly puts both these two sites in the final centuries of the 4th millennium BCE. Additionally, the settlement of Zandwerven, dating to the first centuries of the 3rd millennium BCE, is located on a sandy chenier deposit at the southern end of this dynamic landscape (see Fig. 4).

After setting the scene here, I wish to address three questions here. Firstly, how do we characterise this earlier phase of occupation in the saltmarsh landscape? Secondly, what other evidence for middle Neolithic,

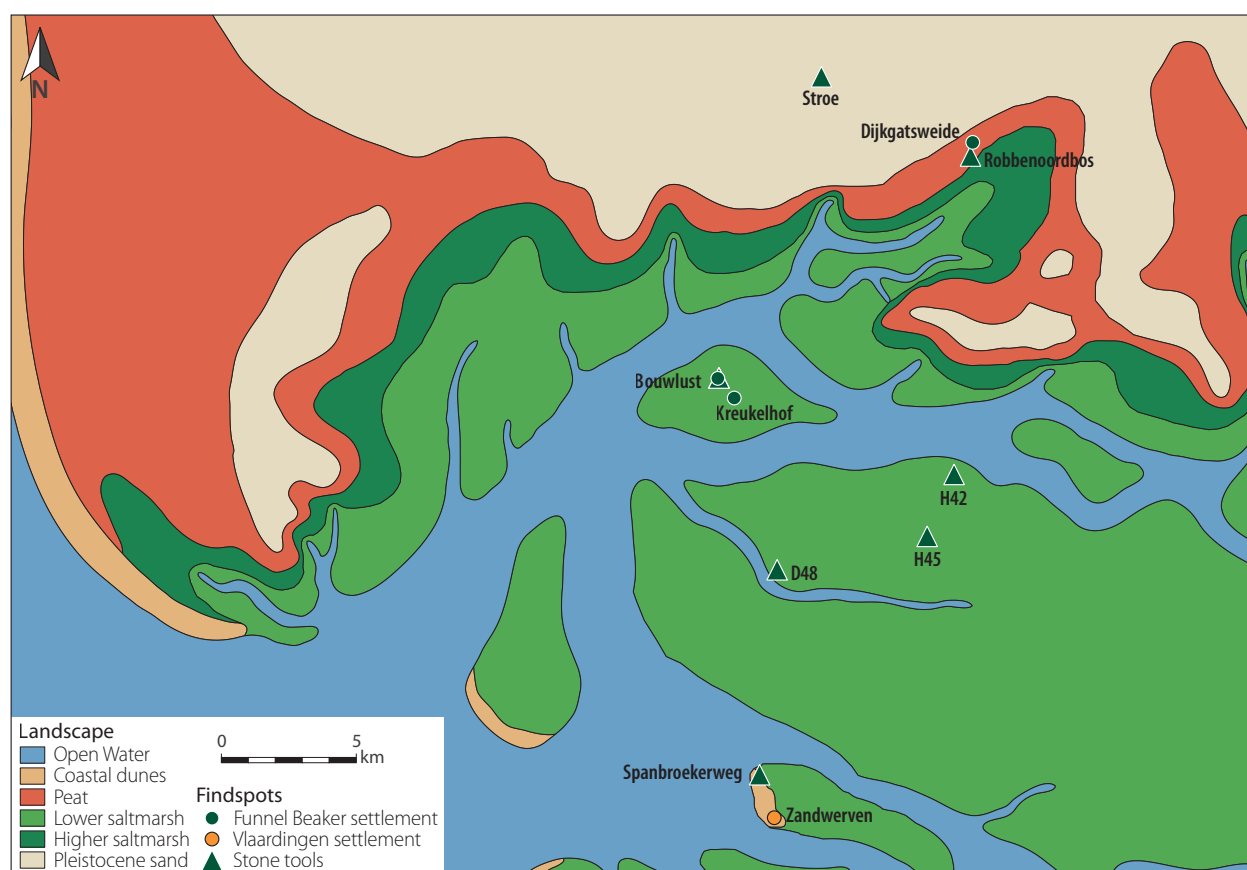


Fig. 2. Palaeogeography map around 3850 BCE (Vos *et al.* 2018), with all the findspots mentioned in the text.

and potentially older, occupation do we have from this marine landscape? And finally, most contentiously,

can we speak of continuity or discontinuity between these middle and late Neolithic communities?

CHARACTER OF THE TWO SLOOTDORP SITES

The site of Bouwlust was found in 1990, and completely excavated during 1991 (Hogestijn and Jager 1991; Hogestijn 1992). The site could not be preserved, because recent ploughing had damaged most of the occupation layer. The site, a shell midden, consists of a c. 750m² extensive black layer, several decimetres thick, containing masses of occupation waste. This midden was excavated in 2x2m squares. Within and below this midden, the fills of pits and postholes appeared. Based on the character and distribution of the postholes, a two-aisled, irregular house plan of 11.0x3.8m was reconstructed by the excavators (Hogestijn and Drenth, 2000). The site was used for the processing and consumption of *Triticum dicoccum* cereals (Brinkkemper 2001), but no ard marks were found. Simultaneously, the site was used for the processing of hunted wild animals such as ducks and deer, but also the husbandry of livestock. Currently there is no clear indication for seasonality based on the presence or absence of animal species (Lauwerier 2001). Interestingly, several axes were also recovered from Bouwlust. While the large majority of stone and flint artefacts was produced on locally available glacial erratic sources, a single axe was probably made from a source of coarse, brown coloured, southern flint, with a potential source near Maastricht (Peeters 2001, 665). The axe was used as a core at Bouwlust, as several flakes stemming from the axe were recovered as well. The other stone tools include a *Fels-Rechteckbeil*, an adze fragment, and two axes made from northern flint.

The site of Kreukelhof was found in 1992, and test-trenches were dug to ascertain the quality of the site in 1993 (Hogestijn 1994). The site, though only c. 300m² in size, is also a shell midden of several decimetres thick, with ceramics clearly pointing to a Funnel Beaker association, and some evidence for wild apple consumption (but much of the archaeobotanical analysis still has to

be carried out). Since the site was covered by later clay sediments, it was only partly affected by ploughing. As such, together with the landowner, it was decided to not further disturb the location and preserve it for a future generation of archaeologists.

Within the MSCA project of the author, with the questions raised above in my mind, these test trenches were reopened in 2022.¹ We sampled the midden for soil micromorphology, lipid biomarkers, phytoliths, diatoms and sedaDNA. Only a small number of the soil micromorphological samples have been analysed up to now, but enough to form a first impression of the character of occupation here at Kreukelhof.

Results indicate that at Kreukelhof the midden consists primarily of distinct horizontal bands of charred organic matter and phytoliths, most likely stemming from reed vegetation. These 'beddings' are interlaced by several thin bands of natural clay and clay coatings, indicating the repeated flooding of the levee, and probable temporary abandonment of the location. This leads to clearly separated occupation phases of only several cm thick, without much bioturbation. On the flank of the midden, these layers appear in secondary position and separated by silty sediments. Here we also find phosphatic minerals and some evidence for reworking and trampling (associated with cattle hoofprints in the field). This was probably a lower lying area, where livestock was grazing. On the top of the midden we find degraded bone fragments, and shell remains, indicative of human culinary practices, and repeated abandonment and weathering. It appears as if shells were only consumed at the end of a habitation phase, being deposited primarily on top of each layer. The combination of the flooding events, and the restricted accumulation of shells on the midden, can infer some seasonality in the recurring practices at Kreukelhof.

OTHER FUNNEL BEAKER EVIDENCE

The two settlements of Slootdorp-Bouwlust and Slootdorp-Kreukelhof are by no means the only findspots dating to the 4th millennium BCE in this marine tidal landscape along the Dutch North Sea coast. A few

decades ago, a dugout canoe was discovered at Dijkgatweide (Kruidhof *et al.* 2011). A radiocarbon date places this dugout around the same time as the Funnel Beaker settlements of Bouwlust and Kreukelhof (Fig. 3).

1 A detailed Dutch-language report on the excavation results is published (Kleijne 2025).

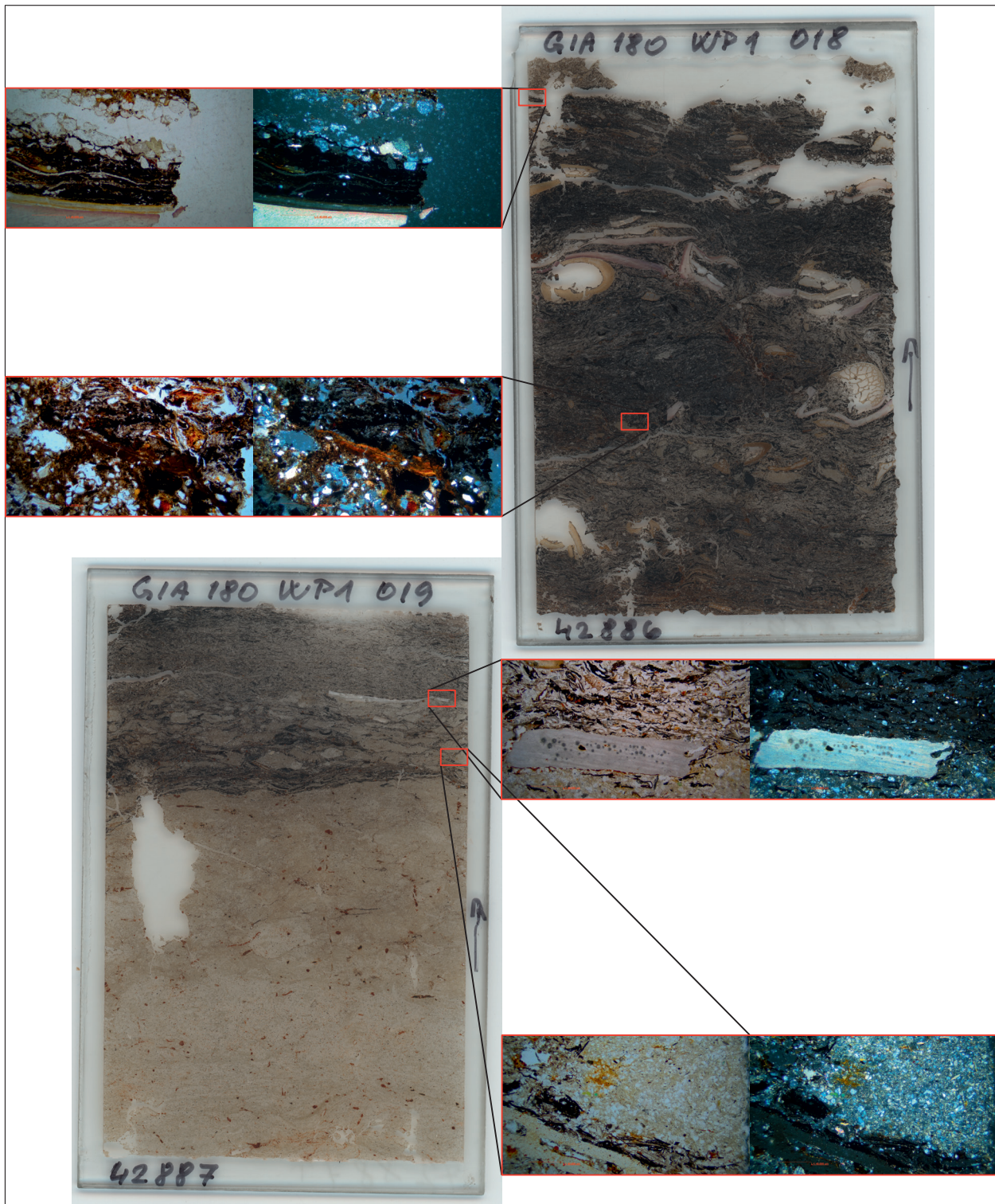


Fig. 3. Thin sections from Kreukelhof, and microscopy photos. Plain Polarised Light (PPL) and Cross Polarised Light (XPL) images show repeated water involvement, clean clay layers and coatings, between the occupation debris (charred organic matter, phytoliths, shells, and bones; photos: Jos Kleijne).

Several stone axes found here are also typical for the 4th millennium BCE. As mentioned above, some evi-

dence for flint and stone axes comes from the Bouwlust excavation.

Many other flint and stone axes were found a long time ago, as loose finds during the earliest land reclamation work and agricultural work. A renewed attention will probably reveal a much clearer picture of their production, use and depositional contexts. For now we resort to this overview. Firstly, a *Spitznackiges Flint-Ovalbeil* was found on plot H45 (Van Der Heide 1956, 1). This object dates typologically to the early Funnel Beaker period (cf. Nielsen 1977; 3800–3400 BCE), but might have been in use for longer, considering the observed evidence for resharpening.

Additionally, a *Dünnnackiges Flint-Rechteckbeil*, (length: 216 mm) was found in Spanbroek near the Spanbroekerweg, 2 km north of the Vlaardingen settlement of Zandwerven (Schermer 1971), on the same sandy ridge (Fig. 2). Based on its size, and the absence of such high-quality flint in the glacial outcrops, such objects have always been seen as evidence for import from the Funnel Beaker North group — “an unsatisfactory rule of thumb” (Bakker 1979, 80). Thirdly, from Stroe, on the Pleistocene outcrop of Wieringen, just north of the saltmarsh area, a semi-finished knob-butted hammer axe is known (Lanting 2018, 96). This is still the only find from this sandy outcrop clearly datable to the Funnel Beaker period.

Typologically less clear are stone tools that could potentially date to the Late Neolithic. The find location however suggests a Funnel Beaker date in these instances. In this respect, two examples of *Dicknackige Flint-Rechteckbeile* should be mentioned. The first example, a relatively short (112 mm) and probably locally made artefact, made from a small flint nodule with cortex still attached, was found in the Robbenoordbos (De Weerd 1965), not far from where later the Dijksgatsweide dug-out canoe came to light. The second axe of this type is

also a small (107 mm) example, found on plot D48 (Van de Walle-Van Der Woude 1988, 290–291). A third axe is a *Dicknackiges Flint-Ovalbeil* from plot H42 (Van Der Heide 1956, 3).

Lastly, the site of Zandwerven, actually the first discovered Neolithic settlement in the Western Netherlands in 1926 (Butter 1935), presents us with several problems. It is associated with stratigraphically separated layers with Vlaardingen-group and Corded Ware pottery; however the stratigraphy is based on old excavations, and the chronology is based on only three samples coming from the younger layers, which also have their own problems of inbuilt age and the potential for a reservoir effect. New research is clearly needed here.

From the above it has become clear that Middle Neolithic occupation, at least from 3200 BCE onwards, was clearly present in North-Holland. The evidence comes from small scale settlements, clearly used (but not solely) for the extraction and gathering of resources, perhaps during particular times of the year, or all year round. In this water-rich area, people travelled using canoes and found ways of making use of stone (hammer-) axes in the saltmarsh landscape.

Evidence for even earlier occupation on the Dutch North Sea coast, the late 5th and early 4th millennium BCE, the period to which we date the Swifterbant occupation in the freshwater landscapes of Flevoland and submerged below the IJsselmeer (see Van Den Breuk et al. 2023), is limited to several finds of loose stone axes, many of them not without reasonable doubt concerning context and typochronology (see for instance Kleijne and Raemaekers 2023). Most importantly, a detailed knowledge of this early tidal lagoon landscape, and possible adjacent Pleistocene outcrops, and their potential for prehistoric communities, is currently lacking.

CONTINUITY OR DISCONTINUITY FUNNEL BEAKER-CORDED WARE

One of the major debates topics in Late Neolithic research is the transformation around 2800 BCE, primarily fuelled by the recent upsurge aDNA studies (Allentoft et al. 2015; Kristiansen et al. 2017; Klejn et al. 2017; Heyd 2017; Schroeder et al. 2019). These studies focus on the intrinsic differences in the character of the funerary rites between the megalithic Funnel Beaker communities, and the barrow-building Corded Ware communities. Many of the burials of these latter communities are associated with the introduction of the steppe ancestry visible in aDNA, first appearing in the Eurasian steppe around 3100 BCE, and appearing westward around 2800 BCE. Simultaneous to this genetic ancestry and the associated burial ritual, we see the appearance of Corded Ware ceramic and stone artefacts as part of funerary grave sets (Wentink 2020).

As such, all these aspects (funerary ritual, material culture and genetics) have become part of a recently (re-) constructed culture-historical monolithic interpretation across Europe. Here, we deconstruct this monolith specifically for the saltmarsh landscape of North-Holland, in order to bring us closer to understanding this complex transformation process.

This monolithic perspective is made even clearer by the recent study of Kroon (Kroon 2024). Specifically for the Western Netherlands, Erik Kroon dismisses the Corded Ware attribution of these settlements, stating that

“Only a small number of Corded Ware vessels appear on these sites” and “the typical Corded Ware funerary practices (...) are absent on these sites”.

(Kroon 2024, 25–26)

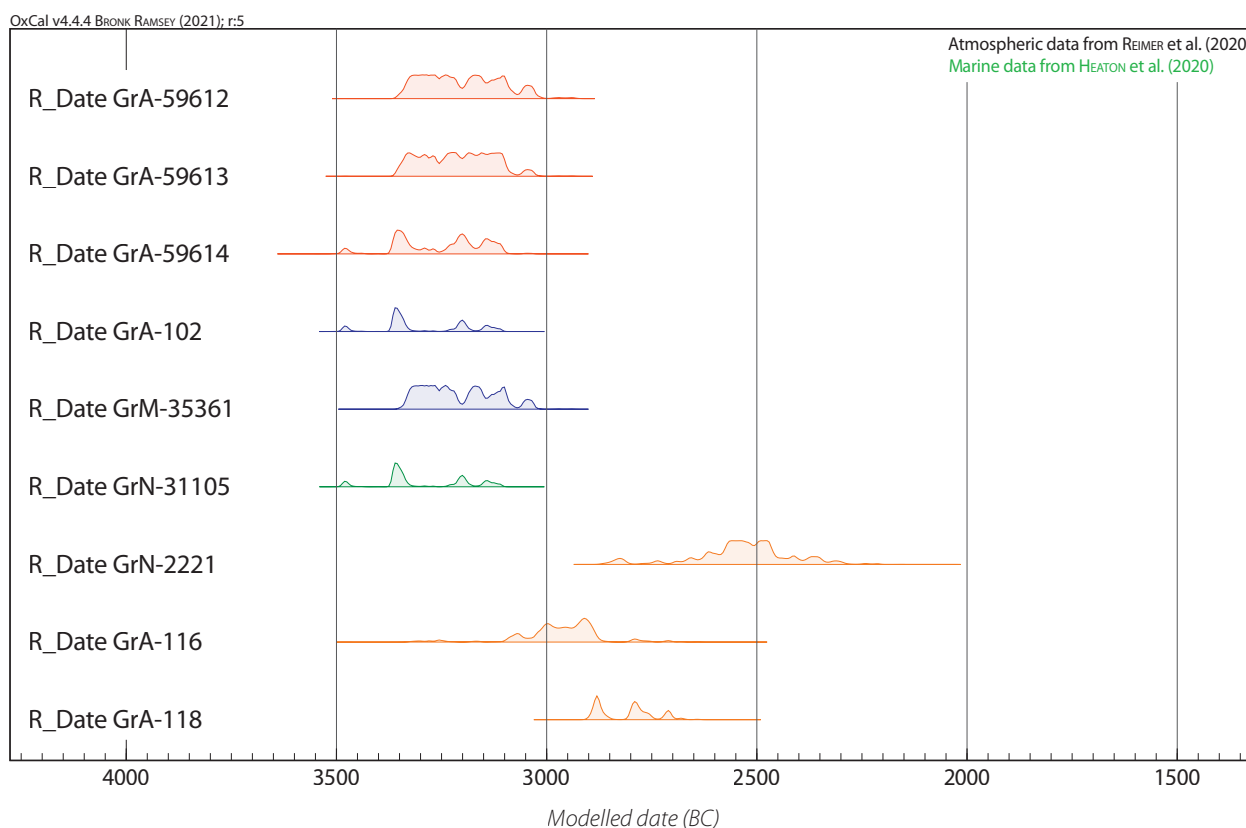


Fig. 4. Radiocarbon dates from Middle Neolithic occupation in the saltmarsh landscape of North-Holland (Red: Bouwlust; blue: Kreukelhof; green: Dijkatsweide; orange: Zandwerven; OxCAL).

However, as we will show below, the situation is far more complex and interesting, and therefore key in discussing the socio-cultural and economic transformations around 2800 BCE.

Burial practices

First of all, there is scant knowledge concerning pre-Corded Ware burial practices from the Netherlands in general. It is generally assumed that the well-known megaliths were used for funerary practices. However, the evidence for collective burial practices coming from these megalithic monuments is low, and primarily based on analogy to well-preserved collective burials abroad. What we do see during the final centuries of the 4th millennium BCE, and continuing during the Corded Ware period, is the use of megaliths for cremation graves and communal rituals (Jöns *et al.* 2013). Simultaneously, we see the use of flat single graves in cemeteries, such as famously excavated at Dalfsen (Van Der Velde *et al.* 2022). For the Western Netherlands, an absence of megaliths is, of course, noted and easily explained by the absence of large natural glacial boulders. Loose human remains have been

found on the settlement of Bouwlust, but no further mention is made (Van Heeringen and Theunissen 2001, 263). Regional Vlaardingen-group funerary customs, also dating to the final centuries of the 4th millennium BCE point to complex rituals. These include several cremation patches, a seated pit cremation burial, and an excarnation structure associated with human remains at Hekelingen III (Louwe Kooijmans 2007), a cremation pit at The Hague Steynhof (Van Zoolingen and Bulten 2021), and loose human remains (following Louwe Kooijmans 2007, 465–466) from Vlaardingen (a skull fragment and a milk tooth), Hazendonk (a skull) and Leidschendam (two calcinated skull fragments). Noteworthy is that many of the above examples, both Funnel Beaker and Vlaardingen-associated human remains, come from contemporaneous settlements.

Between 2800–2450 BCE, there are two formal burials known from our study area: at Mienakker (Plomp 2013) and Sijbekarspel-De Veken (Hogestijn and Woltering 1990), we find single inhumation burials in crouched position similar to the Corded Ware ritual, but clearly without any grave goods and without clear round barrow structures. Instead, at Mienakker, the grave seems to have been situated inside a mortuary chamber which mimics earlier rectangular

earthen and wooden architecture. Also, at both Mienakker and De Veken, the burial is situated inside a settlement location, similar to the Vlaardingen tradition of human remains on settlements. Furthermore, at Mienakker there is clear evidence for the secondary reopening of the grave, as specific skeletal elements are missing. Other human remains are known, only as single loose bones from the settlements of Zeewijk and Aartswoud (Van Heeringen and Theunissen 2001, 110; Zeiler and Brinkhuizen 2013).

This clearly indicates that differences between regions and between periods were not as clear cut: in Vlaardingen, Funnel Beaker and in the subsequent Corded Ware contexts, we see cremation rituals (also including the significance of wild animal remains such as brown bear, during rituals, as pendants or for funerary pelts). At the same time, we find a clear association between human remains and places of communal gathering or settlement during this whole period. The most important change, both in sandy upland areas and in wetland areas such as in the saltmarsh of North-Holland, is the adoption of a more formal ritual of crouched inhumation burials, with specific grave goods. While the specific grave goods and the barrow construction are not adopted, the formal aspect of this ritual is.

Settlement and subsistence economy

With regard to subsistence economy and use of the landscape, lots of positive evidence exists for continuity between Funnel Beaker and Corded Ware in the saltmarsh landscape, and similarities to the Vlaardingen economy for the coastal wetlands. The subsistence of these communities can be characterised as a continuation of the wetland “extended broad-spectrum” economy, a term initially coined by Louwe Kooijmans (Louwe Kooijmans 1993, 102–103) for the Early Neolithic Swifterbant and Hazendonk farmers. Animal husbandry and crop cultivation were carried out on the drier and more sandy levees. The occasional natural flooding of these levees probably increased the nutrients within these levee soils, decreasing the need for artificial enrichment through manuring. At the same time, the extraction of wild resources, the gathering of shellfish and wild halophytic plants, the hunting of large numbers of wild ducks as well as seals, and fishing on estuarine and marine species including cod and haddock, was important for these later Neolithic communities (see for instance Kubiak-Martens 2013 and Zeiler and Brinkhuizen 2013).

The micromorphological evidence at Mienakker and Aartswoud, is comparable to that of Kreukelhof, reviewed above (Exaltus 1992; Kooistra 2001): Layers of burnt stacked reeds denote different subsequent

occupation horizons, and horizontally packed layers of shells, ash and charcoal indicate shellfish roasting and consumption waste. While Kreukelhof shows intermittent use, the occupation at Mienakker and Aartswoud is more substantial, reworked, and continuous. At the same time, all sites show evidence for spatial segregation of activities within the local landscape. The most peculiar, shared characteristic throughout, is the use of waste accumulations as living environment. This implies the necessary practices of waste management and separation, and transformation through fire, but also impacts health and disease during the Neolithic.

Finally, the wooden canoe at Dijkgatweide and evidence for a skin-lined canoe at Mienakker (Nobles 2013) show that all these communities were well-adapted to living amidst the saltmarsh creeks, gullies and even the marine environment, pointing to a deep-rooted knowledge of these wetland natural landscapes

Material culture

The most contentious topic of this discussion is formed by material culture. One has to understand that Late Neolithic settlements in general are quite scarce in typical thin walled and highly decorated pottery by which scholars tend to define these pan-European phenomena (Kleijne 2019). The Corded Ware nature of the pottery assemblages from these settlements, is however well attested by Beckerman (Beckerman 2015), who writes that these thin-walled beakers, of all the familiar vessel types, are “...comparable to those found in Corded Ware funerary contexts in other parts of the Netherlands” (*ibid.*, 241). This indicates that the communities in our study area specifically chose to be part of this wider network, sharing information and adopting particular elements through external influences. The nature of these influences should be the main point of debate, since the pottery shapes and forms clearly show a traditional development from the Vlaardingen-group, undecorated S-shaped vessels (Beckerman and Raemaekers 2009), and the pottery raw material appear to be irrespective of decoration or vessel type.

Additionally, the presence of foodcrusts provides an excellent opportunity for understanding the use of these pottery vessels. The use of these vessels, both thin-walled and thick-walled, both decorated and undecorated, was primarily for the cooking of fish-based porridges and stews (Kubiak-Martens *et al.* 2015), not unlike traditional Neolithic pottery (see (Demirci *et al.* 2020). While these practices are at odds with a ritual use as a container for alcoholic beverages, generally assumed for funerary Corded Ware pottery, these are not mutually exclusive and primarily reflect the nature of the archaeological dataset, taphonomic considerations,

specific depositional practices (e.g. cleaning a cooking vessel before using it in a burial ritual), and preservation conditions.

Taking a southern detour, we find a similar situation at the site of N11, located on a crevasse deposit along the Old Rhine river. Here, the excavators previously described Vlaardingen-group occupation with minor bioturbated Corded Ware sherds (Diependaele and Drenth 2010). This site is now clearly a Corded Ware site, based on a re-analysis of the soil micromorphology and radiocarbon chronology (Kleijne and Huisman 2023). At this site, the pottery technology shows both local and supra-regional influences indicative of a complex transformation process and incorporation into the wider Corded Ware phenomenon (Kroon *et al.* 2019).

Back to the saltmarsh. Reviewing stone tools, we find typical Corded Ware type artefacts. A recent inventory identified 33 of the typical Corded Ware hammer-

axes, and also a characteristic Keulenkopf (at Kolhorn, (Drenth and Kars 1990), and potentially also several typochronologically less clearly identifiable stone and flint axes. All these stone tools are found both as loose finds, even in concentrations such as on the Strijdhams plot of land, as well as on clear saltmarsh shell midden settlements, such as at Aartswoud (Van Heeringen and Theunissen 2001, 111), where in both instances eight hammer-axes have been recorded.

All in all, the choice in pottery technology and decoration motifs, and their use of characteristic stone and flint axes in an area devoid of natural stone source, indicates these communities were part of a well-connected world, and adopted clear Corded Ware elements in their funerary ritual, as well as in their daily life. At the same time, these communities remain attached to the landscape's subsistence opportunities, and the traditional cooking practices.

CONCLUSION

In the North-Holland saltmarsh landscape, the occupation of saltmarsh levees starts at least around 3200 BCE. Can we relate this "colonisation" of the salt marshes to the social changes in Funnel Beaker society observed by Johannes Müller *et al.* (2020)? It appears unlikely, as we find temporary camps, and potentially seasonal occupation related to more permanent settlement and agriculture on higher sandy soils, indicating clear separation of work tasks and an existing social organisation. These communities are associated with Funnel Beaker material culture, but they are also well-adapted to living in a coastal environment, and open to other cultural influences and exchanges.

This way of life intensifies after 2800 BCE, and larger year-round settlements appear in the saltmarshes. Perhaps this is also a demographic trend concurrent with the wider European picture, with an increasing population size, and the potential influx of new individuals bringing new genetic patterns (however this is still under scrutiny). The changes we do see relate

to pottery decoration motifs, and the formal burial of specific individuals. However, even here we see the continuity in practice: pottery is still used for cooking traditional foodstuffs, and this formal burial is still part of a traditional ritual practice, in which there is no place for standardised grave goods.

As such, we don't see clear indications for social upheaval during the later Funnel Beaker period, as made clear by Johannes Müller's recent work (Müller *et al.* 2020; Müller 2023), or the rise of new elites during the Corded Ware period. Perhaps these communities opposed such notions altogether: Keine Macht für Niemand? Perhaps the importance of access to land and controlling animal resources such as cattle or sheep/goat for manure and milk, plays a more prominent role in societies on poorer sandy soils. There we find cattle burials and palisaded enclosures, as well as the later Corded Ware phenomenon grave set. Where those societies more open to the emergence of new elites?

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Leaving the Fields of Asphodels

Ulrike Sommer

KEYWORDS: Sub-Neolithic, Mesolithic resurgence, forest clearance, population development

Abstract

So far, the analysis of A-DNA has shown very little genetic admixture from local hunters and gatherers in the early Neolithic of the Southeast- and central European Neolithic. Between c. 4000-3700 BCE, this genetic input increases substantially, however. Wolfgang Haak *et al.* (2015) claim a „Mesolithic resurgence“. Such a resurgence does not only presuppose the survival, but also a substantial population increase of foragers, however. So far, archaeological evidence does not support this. In this contribution I discuss how changes in environment caused by the introduction of farming led to environmental changes that could have been beneficial for local foragers. Forest clearance, forest management, woodland pasture and the formation of hillwash caused by deforestation and agriculture will have increased

animal biomass and thus game. Less dense forest cover and the formation of secondary forest increased the supply of starch rich nuts as well as ferns and other types of groundcover. The eutrophication of rivers and lakes connected with a slower run-off encouraged the spread of starchy swamp- and waterplants like bullrush, reeds and water chestnut. In the Mediterranean, grazing promoted the spread of affodils - the flowers of the Elysian meadows known from Greek and Latin epic poetry. This increased range of food plants could have supported the population increase of local foragers, whose existence is almost totally unsubstantiated up to now. Proving the use of these resources is difficult, however, and will have to depend on the analysis of parenchyma.

Zusammenfassung

Studien von aDNA zeigen eine sehr geringe Beimischung von „Jäger-Sammler Genen“ in der ersten Phase der Neolithisierung Südost- und Mitteleuropas. Mit dem Beginn des Jungneolithikums erhöht sich deren Anteil jedoch deutlich, Wolfgang Haak et al. (2015) sprechen von einer „Mesolithic resurgence“, also einem mesolithischen Wiederaufschwung zwischen ca. 4000 und 3700 v. Chr. Ein solcher setzt jedoch nicht nur das Überleben bei Jägern und Sammlern im 5. und 4. Jahrtausend voraus, sondern außerdem ein deutliches Bevölkerungswachstum, wofür sich archäologisch bisher kaum Anzeichen finden. In dem Beitrag diskutiere ich, wie die Umweltveränderungen durch die Einführung der Landwirtschaft, insbesondere Rodung, Waldweide, einer gezielten Waldwirtschaft und verstärkte Sedimentation, sich positiv für

Jäger und Sammler ausgewirkt haben könnten. In einer aufgelichteten Landschaft erhöht sich nicht nur die tierische Biomasse, sondern auch stärkehaltige Pflanzen wie Nüsse und andere Baumfrüchte sowie Farne finden einen besseren Lebensraum. Die Eutrophisierung und Sedimentierung von Wasserläufen und Seen erleichtert die Verbreitung von Wasser- und Sumpfpflanzen wie Rohrkolben, Schilf und Wassernuß. Im Mittelmeergebiet ist es vor allem Beweidung, aber auch Erosion, welche die Ausbreitung der Totenblume Affodil begünstigt. Diese neuen Nahrungsmittel können einen Bevölkerungsanstieg der bisher weitgehend hypothetischen lokalen Wildbeuter unterstützt haben, ihr Nachweis ist jedoch schwierig und vor allem durch die Analyse von Parenchymien möglich.

THE EARLY NEOLITHIC

In 1983, Edward Sangmeister published a nice little graph illustrating the potential relations between local hunter-gatherers and the incoming farmers of the Linearbandkeramik (LBK) in southwest Germany. Upon their arrival, the locals could retreat, leaving the land to the colonists with their domesticates. Alternatively, some of the locals would retreat, while others join the newcomers, or all locals might become farmers and slowly assimilate the newcomers, contributing their cultural heritage to form a new type of culture.

Archaeological finds seem to support the first alternative — with the more nasty alternative of the locals massacred, sacrificed or even eaten by the newcomers, as was once suggested for the Jungfernhöhle (Kunkel 1955; 1988) now largely abandoned. Genetic data now seem to indicate that Edward Sangmeister's graph from 1983 does not actually represent alternatives (Fig. 1), but rather a chronological development, be it with an amazing time lag of a thousand years or even more.

Possible reactions of the local population to the immigrants and their culture

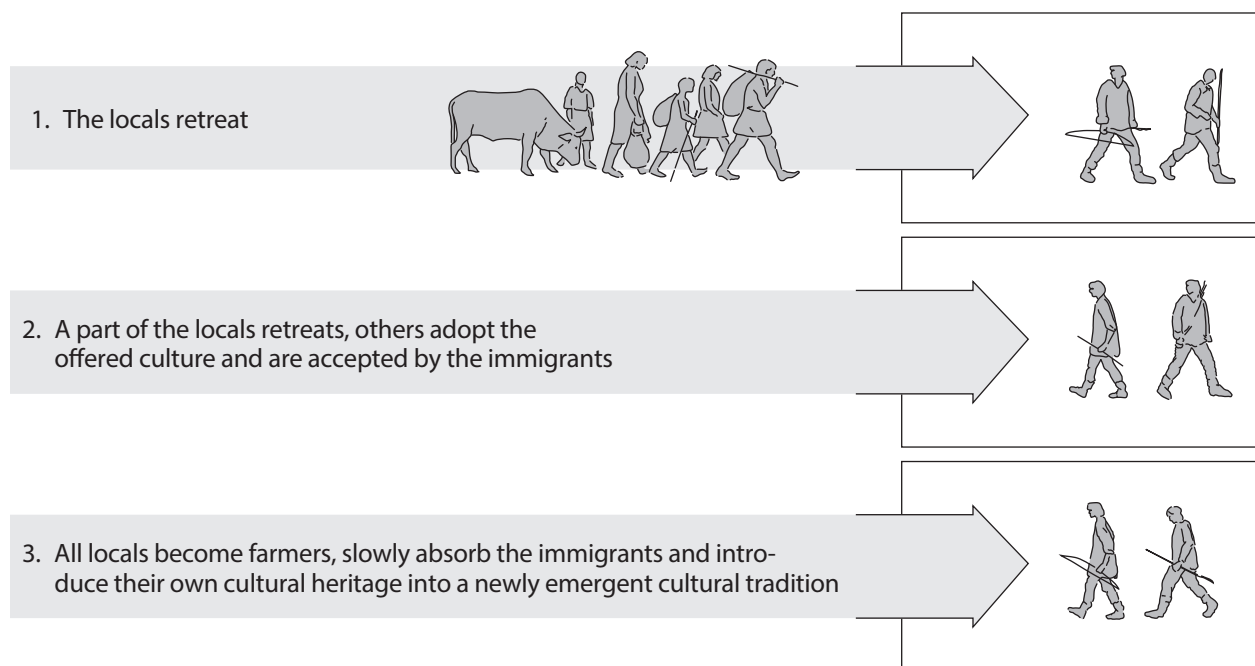


Fig. 1. Contact between immigrating LBK Farmers and Mesolithic populations, possible outcomes (after Sangmeister 1983, 468, revised by Karin Winter).

On the face of it, seems extremely unlikely that a biologically viable population could remain hidden for such a long time period. If they did, it has rather worrying implications for archaeologists, especially those who attempt to estimate population densities (Shennan 2009; Müller and Diachenko 2019). The finds from the 'Blätterhöhle' in Hagen (Westphalia) have revealed, among others, burials dating between 3900–3450 calBC that show what geneticists term purely "HG" (Hunter-Gatherer) haplogroups (Bollongino 2013; Lipson *et al.* 2017). While these terms are deeply problematic and potentially misleading, as diet, economy or presumed former abode ("Anatolia", "steppe") are not transmitted biologically, they will be used in the following for lack of an accepted alterna-

tive. Their diet was mainly based on game and freshwater fish (Orschiedt *et al.* 2014, 27–28). As the bones were found in severely bioturbated layers, there are no clear links to artefacts that would indicate a cultural affiliation. Jörg Orschiedt *et al.* (2014; 2018) used the finds from the 'Blätterhöhle' to claim the existence of a "parallel society"; Hunters and gatherers continuing their lifestyle here while other areas were already settled by farmers. This phenomenon is not uncommon in Northern Europe, with the Swifterbant culture of the coastal Netherlands and various populations using pointy based pots (Woodland Neolithic in the Russian terminology) in Northern Scandinavia and on the eastern coast of the Baltic, where this is often called the Subneolithic (Piličiauskas *et al.* 2016).

Populations that dig no pits or graves have a low archaeological visibility. If they use no, or very plain and badly made pottery and do not produce a unique or elaborate type of chipped and ground stone tools, their chance of discovery is even lower. The Rocadour or Atlantic Cardial, “*Neolithique ancien énigmatique*”, as the excavator called it (Niederlender *et al.* 1966, 105) was identified in the excavation of the eponymous cave more famous for Gravettian cave art (Niederlender *et al.* 1966) and is still badly known. The quite distinctive early Neolithic La Hoguette pottery style was only identified as a cultural unit of its own in 1983 (Jeunesse 1987), and it seems unlikely that the Dutch Swifterbant culture would have been easily discovered without the creation of the IJsselmeer polders. This makes the existence of invisible populations less unlikely, and we may even suspect them in later times, for example during the Beaker Period.

Terra nullis or apartheid?

The problems of reconstructions, even if they are schematic and innocuous as Edward Sangmeister's (1983) is that they stick in the mind and it is difficult to get rid of the picture. An alternative picture could show the farmers arriving — with nobody there to react to them at all, as the final Mesolithic populations were not particularly interested in the thickly wooded chernozem plains on the loess, with a low density of game and edible plants for gathering (cf. Vanmontfort 2008). The more upland, lacustrine and coastal distribution of Mesolithic sites would support this scenario, but, of course, the archaeological visibility of tiny microliths in areas with a six-millennium long history of agriculture and concomitant erosion has to be taken into account.

While there are no Iron Gates or Dnjepr-rapids in central Europe, rapids in the big river valleys probably still were important sites for catching migrating fish (see Gehlen *et al.* 2017, 56–57 for the importance of fishing). The river valleys were rarely settled till the late phase of the Linear Pottery Culture (Quitta 1969), if this is not an impression caused by differential archaeological visibility as well. The possible avoidance of areas with a high density of Fisher-Hunter-Gatherers like the coast might also have worked for large aggregation sites in the lowlands. Settlements of the Linear Pottery Culture never actually reached the sea. In Northwest and Northern Europe, there is a conspicuous avoidance of marine food as well (e.g. Schulting 2015).

Given the evidence for transhumance in the Linear Pottery culture, were the cows and some children spent the summer off the loess (Knipper 2011), as well

the location of mining sites like Sulzburg (Goldenberg *et al.* 1998, Goldenberg *et al.* 2003) in the mountains of the Black Forest, a total ignorance or avoidance between the two groups seems increasingly unlikely. Additionally, the formative LBK settlement of Brunn am Gebirge 2 contained burials of two persons of, possibly recent HG ancestry (Nikitin *et al.* 2019). Given the evidence of annual transhumance to the hills, a comparable movement can be expected for the sandy soils beyond the loess distribution in the North of Europe and possibly into the circumalpine wetlands in the south.

The low degree of human interbreeding observed by the geneticists could thus hint at conscious avoidance by both parties, probably aided by limited areas and annual windows of time for contact. Hence, social factors need to be explored (cf. Hofmann *et al.* 2022). The conspicuously low importance of hunting in the LBK (Fig. 2; see Becker *et al.* 2024 for a more detailed local study) points in the same direction. Forest products may have been represented as unclean and defiling. In a population lacking any hunting-skills, the temptation to run away into the forest, for example to escape the authority of the village elders who controlled the means of reproduction in the form of imported status items (Sommer 2011) like spondylus shells, and amphibolite shoe-last adzes from Jistebsko in Bohemia (Christensen *et al.* 2006) would be quite low. A prescription of hunting and contacting forest dwellers would thus have stabilised the social order and the position of the elders. On the other end, an experienced hunter would have had nothing of interest to offer to the village societies and could not hope to achieve a marriage, lacking the necessary patronage. Jörg Orschiedt *et al.* (2014, 27–28) point to status differences between modern fisher-hunter-gatherers and farmers as another factor preventing “mixed marriages”. Even if the same was true for the early Neolithic, the apparent lack of even clandestine or violent sexual encounters, or rather their offspring is striking. There is little evidence for contact in the material culture as well. The endlessly discussed trapezes in the oldest phase of the LBK (cf. Gronenborn 1999, 169–171) could have been derived from Starčevo-Körös or Vinča contexts as well, and they disappear at the same time as footed and carinated bowls, that is, other links to the culture/s of origin. Catherine Frieman and Daniela Hofmann (2019) have rightly pointed out the danger of “othering” Mesolithic populations by archaeologists and over-emphasizing the differences between the two groups. However, “othering” can also be part of a strategy of social control, if practiced by members of the early farming community.

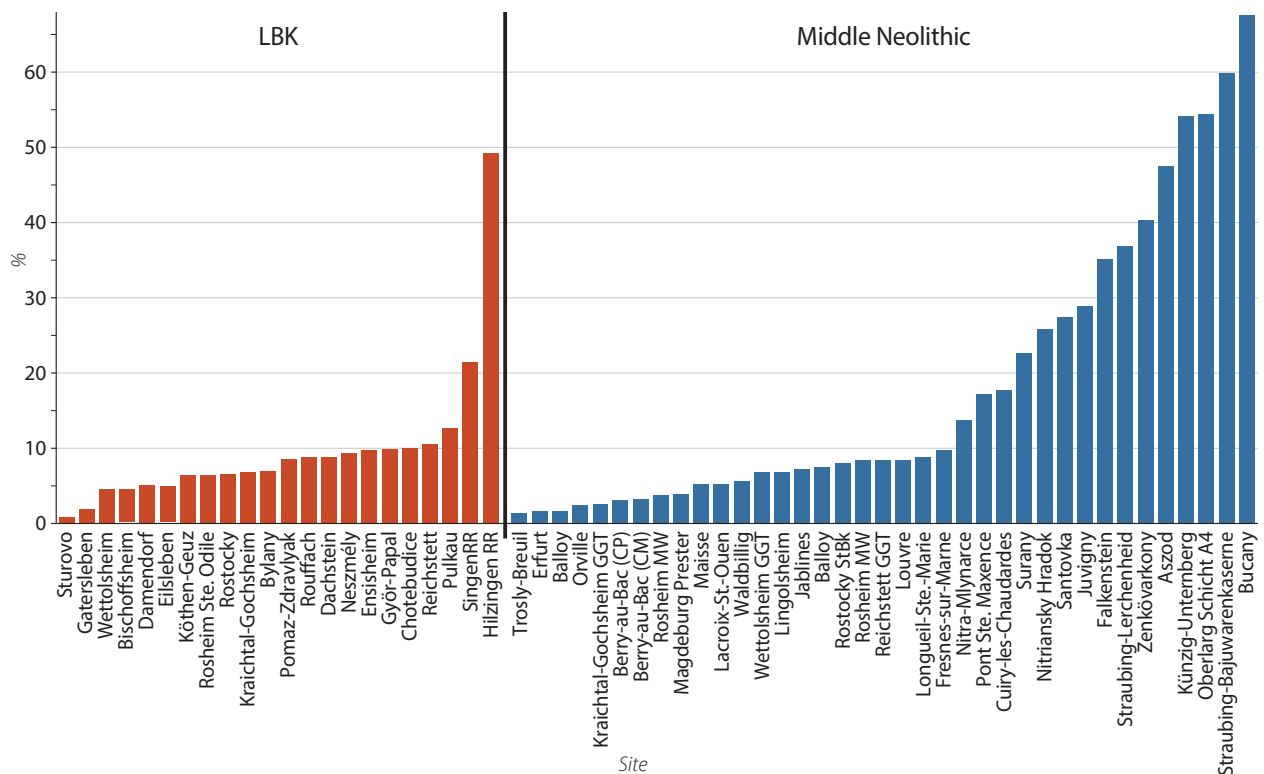


Fig. 2. Hunting in the LBK and the Middle Neolithic (after Arbogast 2001).

THE “MESOLITHIC RESURGENCE”

In 2015, Wolfgang Haak *et al.*, based on a still very small sample, noted an increased genetic input of people related to West European Mesolithic populations (WHG) in the Central European “Middle Neolithic”. In the meantime, the evidence has increased (for example, Lipson *et al.* 2017; Beau *et al.* 2017; Brunel 2020; Rivollat 2020). Wolfgang Haak *et al.* (2015, 210) claimed that the “Middle Neolithic” populations of Germany and Spain have “18–34% more WHG-related ancestry than Early Neolithic populations”. That would translate into one WHG grandparent per Middle Neolithic farmer, and into Late Neolithic farmers in the German terminology — the cultural context is either given as Baalberge, Gatersleben (Funnel Beaker Culture) or early Michelsberg (which would put the period between c. 4000–3700 BCE in Germany). Given that the settlement area of farming populations had substantially increased compared to the western Linear Pottery culture and derived “Danubian” populations, with settlements now being built on less fertile soils and in higher elevations, this implies a considerable number of hitherto hidden fisher-hunter-gatherers. I have tried to get estimates from geneticists about the number of people necessary to achieve this transition — so far without success.

One of the main arguments why farming migrants could spread so quickly into large parts of Europe has

always been the low population density of fisher-hunter-gatherers. Given that these population probably lost part of their habitat — albeit a less important one — with the advent of Neolithic settlement, a decrease in their population would be expected. Even with high mobility — which is the opposite of what we know about final Mesolithic societies with a normally very local lithic raw material spectrum (Gehlen *et al.* 2017; 2023), and a suddenly high social acceptance of inter-group sex and procreation on both sides, it is difficult to imagine how this degree of interbreeding would have been achieved if the descendants of Final Neolithic fisher-hunter-gatherers continued their previous economic strategy.

In my opinion, the most likely explanation for this resurgence is a substantial increase in the number of WHGs during their period of archaeological invisibility. In the following, I am going to argue that the spread of agriculture actually proved beneficial for the local populations, who changed their economic base substantially. This would argue for a case of transculturation rather than passive acculturation (cf. Keehn *et al.* 2019, 8). Given the limited size of this contribution and the obvious limits of my expertise, this claim is going to be based on very patchy data and a lot of speculation.

The Neolithic is great for hunters!

Forest clearance

It is now widely accepted that Mesolithic populations actively managed woodlands. The Mesolithic fish fences found in the Baltic (for example the late Ertebölle Neksø fence with a height of 4 m and an estimated length of 200 m, Fischer and Olson 2021) would have needed large areas of coppiced woodland to produce the necessary four-year-old hazel rods. Evidence for forest clearance by fire has been observed on the British Isles since the 1970s (e.g. Smith 1970; Simmons 1975; 1999; Mellars 1976; Preece *et al.* 1986; Simmons and Innes 1988; Brown 1997; Davies *et al.* 2005) and is increasingly found on the continent as well (Tolksdorf *et al.* 2013; Blaesild *et al.* 2024, Sánchez-García 2024; Dörfler *et al.* 2024, 185–186). This fire-setting was probably mainly used to increase forage for game, and also to facilitate better passage for hunters (see Mellars 1976 and Davies *et al.* 2005 for ethnographic examples). The clearings created by farming communities would have been very useful the damp lowland forests that are more difficult to set on fire, and the secondary growth on abandoned settlements and fields provided rich forage for game, as well as fruits and nuts for human consumption (Kreuz 1990).

The hazelnut is emblematic and rather ubiquitous in the Mesolithic. In addition, acorns provided a starch rich food (Mason 2000), palatable if not tasty after leaching with potash or urine (Kroeber 1925; McCriston 1994; Robinson *et al.* 2007). Some taxa of oak (e.g. *Quercus ilex* subsp. *ballota*), are edible without treatment, as reported already by Strabo (García-Gómez *et al.* 2017). The easiest way to change a low-status and normally tannine rich and bitter nut into something with higher status and easier to eat is, however, to feed them to the pigs (the dehesa system of Spain, García-Gómez *et al.* 2017). Pigs formed the basis for socially important feasting in places as wide apart as Melanesia and Ireland. Pigs are also an easy, but almost invisible domesticate, given the frequent crossbreeding with wild pigs (Frantz *et al.* 2019) and the problems of telling the two apart. The ivory carvings of pigs and acorns (Whittle 2018, 201) from the Chalcolithic mega-Dolmen of Montelirio near Seville (Gaydarska 2022, 51–62) indicate the importance of this resource, in addition to almost ubiquitous finds of carbonised acorns well into the Iron Age.

In SW Britany and presumably further South in France, the walnut (*Juglans*) is found from c. 6000 BCE onwards (Joly and Visset 2009, 176). It provides oil as well as starch. In the Mediterranean area, sweet chestnut (*Castanea sativa*) is an important and tasty source of starch. Its distribution can be improved by controlled burning (Morales-Molino *et al.* 2015), as observed primarily in Roman times.

Legumes, for examples wild peas, lentils (*Lens culinaris*), bitter vetch (*Vicia ervilia*), chickpea (*Cicer arietinum*), yellow pea (*Lathyrus aphaca*), hairy vetchling (*Lathyrus hirsutus*), red vetchling (*Lathyrus cicero*) and common vetchling (*Lathyrus cicero*) were found in the Mesolithic layers of caves in southern France and Mediterranean Spain (Abeurador: Vacquer *et al.* 1986; Dourgne, Sapètre: Marinval 1986, van Willigen 2006, 93–94, Gehlen 2010, 673, Coves de Santa Maira: Aura Tortosa *et al.* 2005). These species also benefit from more open ground, created by fire or, for example, the grazing of sheep, goats and cattle.

While there is normally a good chance of finding carbonised seeds or shells of fruits and nuts, tubers are more difficult to trace. In the Mediterranean, various species of Asphodels spread in the wake of deforestation and overgrazing (Fig. 3). They have fleshy and starch-rich roots. Unfortunately, I did not yet have the chance to try them out yet, as they dislike the British weather and will not grow in my allotment. To the best of my knowledge, no archaeological evidence for prehistoric asphodels exists. In his “Works and Days” Hesiod mentions the plant in the context of “bribe-swallowing lords”:

“Fools! They know not how much more the half is than the whole, nor what great advantage there is in mallow and asphodel.” (Hesiod, “Works and Days” verse 40)

Supposedly, mallow and asphodel, most likely *Asphodelus albus* refers to the food of honest and modest smallholders (Brout 2003, 98). According to Nicolette Brout this plant is, despite its humble connotation, connected to the Golden Age, when men did not have to work the fields to grow their grain. As a wild plant, it can also be collected without the need for cultivation. Mallows and asphodels are thus food for people that are close to the divine (*ibid.*, 101). The latter was sacred to Apollo Genetor on Delos (Brout 2003, 103). The consumption of asphodels is also described by Pliny and Theophrast.

In Denis Diderot’s Encyclopédie for modern times, Louis Jean Marie Daubenton and Urbain de Vandesne recount that the “nutritious root” can be eaten in times of famine and is also cleansing, incisive, orexigenic, diuretic and emmenagogic, as well as curing tumors and ulcers and driving away vermin (Brout 2003, footnote 2). Johann Georg Krünitz (1773–1858, lemma Asphodelie) describes the different species of afodils and their cultivation in some detail. Their roots could be used for starch. After soaking and boiling the roots „to get rid of their acerbity” (presumably caused by tannins), the pith should be mixed with barley and wheat flour as well as salt to make bread in years of bad harvest. In addition, there are numerous medici-



Fig. 3. White affodils (*Asphodelus albus*) in the Sierra Pelada, Valencia, Spain (Laborinquen 2021, license: Creative Commons CC0 1.0 Universal Public Domain Dedication. Wikipedia commons: Gamones en El Sabinar de San Vicente del Raspeig.jpg).

nal uses, it can be used, among others, against smelly feet, boils, buboes, hairloss, unclean skin, putrefying wounds, mange and scabies, swine fever and mice.

Better known are the fields of asphodels in the Underworld, as described by Homer in the *Odyssey*. Hermes of Cyllene, “the healer of sorrow” leads the spirits of the dead

“down into the dark abode of death. When they had passed the waters of Okeanos and the Rock Leukas, they came to the Gates of the Sun and the District of Dreams, whereon they reached the Meadow of Asphodel where dwell the spirits and shadows of them that can labour no more.” (Homer, “*Odyssey*” 24, 10–14.)¹

According to Hesiod’s *Theogony* (310), the souls of the dead face judgement by Hades and the Cretan kings Minos, Aiakos and Rhadamanthys in this meadow. The souls of the wicked are cast into Tartarus, the just as-

cend to the Elysian Fields, while those who were neither virtuous nor evil remain in the fields of asphodels (Román López 2006/07, 341). In this context, the asphodel is not perceived as a desirable food, the spirits crave blood rather than carbohydrates, as related in the *Odyssey* and later by Vergil in the *Eneid*.

The tubers of *Orchis mascula* and *Orchis militaris* contain salep, a starchy polysaccharide. These plants grow in light woodlands or meadows and their habitat could also have extended by forest clearing and grazing. The roasted starchy roots of common bracken (*Pteridium aquilum*), a fire tolerant clearance indicator, are used as food in many parts of the world (Wollstonecroft 2007, 195 table 4.2, 246 table 5.4; Schellhaas 2020, 91, 133; Norton 1979) even if the plant is poisonous in all parts (Morales *et al.* 2014, 196). Unfortunately, given the additional use of the fronds for bedding (Dugstad 2022, 40–41) and of the roots for basketry (Kroeber 1925, 571),

1 Translated by Samuel Butler, Revised by Soo-Young Kim, Kelly McCray, Gregory Nagy, and Timothy Power,

<https://chs.harvard.edu/primary-source/homeric-odyssey-sb/#24t> ; last access 2nd October 2025



Fig. 4. Water-chestnut (*Trapa natans*) choked Hortobágy river in the Hortobágy National park, eastern Hungary (Photo: Ulrike Sommer).

concentrations of fern spores in Mesolithic settlements (Dugstad 2022, 40–41) cannot be securely interpreted as evidence for their use as food.

Aquatic resources

A second category of foodstuffs rich in starch consists of aquatic or marginal plants. They often benefit from silting and the eutrophication of lakes and rivers.

The water chestnut (*Trapa natans*), a swimming annual plant, produces very distinctive heart-shaped horned seeds that are very nutritious and, when roasted, have a delicious nutty aroma, hence the name. Remains of *Trapa natans* have been regularly found in the circum-alpine lakeshore settlements (Heer 1865; Karg 1996; Karg 2006; Tolar *et al.* 2011) and in several Neolithic sites in Serbia and Montenegro, among them the Vinča settlements of Opovo and Gomolava (Borojević 2009). The plant can cover the whole surface of shallow lakes like the shores of Lake Ohrid and slow-flowing rivers. The water-chestnut is still common today in areas like the Hortobágy in eastern Hungary and the Upper Tur in northwest Romania (Fig. 4) and would have been an easily harvested source of carbohydrates for humans in late summer. In historic times, it was mainly used as pig-fodder, as the seed is quite laborious peel out of the hard outer shell.

Bullrush (*Typha latifolia*) is a typical plant of shallow eutrophic lakes, rivers and creeks (Fig. 5). The starchy roots can be roasted, or pitboiled. While completely tasteless, it provides a very rich food resource that is easy, if rather unpleasant to harvest. Several Romanian, Hungarian and Ukrainian colleagues recalled it as emergency food for rebellious Cossacks, Hajduks and robbers, but could not provide a source.



Fig. 5. Bullrush (*Typha latifolia*) in the Cehal, Satu Mare district, Romania (Photo: Ulrike Sommer).

In the pre-drainage Carpathian basin, these aquatic plants probably formed a richer source of carbohydrates than cereals, which could only be grown on the relatively dry levees of the rivers (Kreuz *et al.* 2020, 105–108). Sea clubrush (*Bolboschoenus maritimus*) is another palustrian and maritime plant with a high starch content in the roots (Wollstonecroft *et al.* 2008) that benefitted from a higher content of nutrients in the water. However, there is also a hierarchy of foodstuffs. Tubers are normally held in lower esteem than cereals, the same as wheat is seen as superior to rye or oats, let alone millet. Before it recently became fashionable, flour from sweet chestnuts was a poor person's food. Tubers and tree fruits may well have borne the stigma of “poor men's food” even in prehistory.

Additionally, tubers are also quite difficult to trace archaeologically. Recently, there has been some progress in identifying parenchyma, that is, unspecific ground cells which form the primary component storage organs like enlarged stems of large stems and vegetative underground storage organs like tubers, rhizomes and corms (Barron and Denham 2022, 1; Pryor *et al.* 2013, 972; Hather 2000). Parenchyma have

been successfully used in the identification of hunter-gatherer food sources (e.g. Berihuete-Azorín 2021; Bishop 2023; Pryor *et al.* 2013; Wollstonecroft 2007; Wollstonecroft *et al.* 2008) and tropical plant foods (Barron *et al.* 2022), but this not yet a common field of research in Europe. In addition, starch analysis of food crusts and dental calculus offers some chance of identification.

...up to a point

A systematic search for parenchyma can help to decide if the food sources discussed above were actually used, either by farming groups or by Subneolithic populations. Use wear analysis (van Gijn and Little 2016) and potentially chemical analysis (Schellekens *et al.* 2013) could also prove useful. However, that leads to the second question of why the descendants of Mesolithic fisher-hunter-gatherers left the fields of asphodels and mixed with the farmers. In this case, population pressure is probably the answer. But that would be another article.

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Then and Now – What We Have Learned About Adriatic Neolithic Chronology Since Müller (1994)

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KEYWORDS: Neolithic, Impresso, Danilo and Hvar, petrography, radiocarbon, typochronology

Abstract

The number of radiocarbon (^{14}C) measurements associated with East Adriatic Neolithic pottery has increased tenfold in the three decades since Johannes Müller's 1994 monograph on early Neolithic Impressed Ware, and archaeometric analyses have been undertaken on

many of the assemblages he studied. We collate these results and ask if they support, contradict or elaborate Johannes Müller's interpretations, and whether new questions have emerged over time.

Zusammenfassung

Die Zahl der Radiokarbonmessungen (^{14}C), die mit ostadriatischer neolithischer Keramik in Verbindung gebracht werden, hat sich in den drei Jahrzehnten seit Johannes Müllers Monographie von 1994 über frühneolithische Impressoware verzehnfacht, und an vielen der von ihm

untersuchten Stücke sind archäometrische Analysen durchgeführt worden. Wir stellen diese Ergebnisse zusammen und fragen, ob sie Johannes Müllers Interpretationen stützen, widersprechen oder vertiefen und ob sich im Laufe der Zeit neue Fragen ergeben haben.

INTRODUCTION

Chronology, both relative and absolute, was a key aspect of Johannes Müller's research on the Adriatic Neolithic (Chapman and Müller 1990; Müller 1988; 1991; 1994). His 1994 monograph focused on early Neolithic Impressed Ware (IW) pottery, its links with earlier and later traditions (Castelnovian Mesolithic, Danilo and Hvar Neolithic pottery respectively), and with early Neolithic pottery traditions in southeast Italy, the Aegean, and the central Balkans. He drew potsherds from 20 sites on the Croatian coast, and one in Italy,¹ and proposed a three-phase typochronological sequence for Croatian IW: Impresso A (simple unconnected impressions or incisions, covering the whole surface); Impresso B (zigzag designs, added to IW A motifs); Impresso C (fine *tremolo*/rocker decoration and geometric incisions, added to IW A and B motifs).

Johannes Müller (1991) interpreted the 16 available ^{14}C dates to date these three phases (Impresso A: 6100 to 5800 cal BC; Impresso B: 5800–5600 cal BC; Impresso C: 5650–5600 cal BC). A few ^{14}C dates suggested that the first IW appeared in Apulia as early as 6600 cal BC, and that east Adriatic IW was therefore derived from south-eastern Italy (Müller 1994, 280). Despite the large uncertainties in the calibrated dates, John Chapman and Johannes Müller (1990) perceived a south-north gradient in the oldest dates for the eastern Adriatic Neolithic. Although there was no ^{14}C evidence from open-air sites, typochronology allowed John Chapman and Johannes Müller (1990) to reject Šime Batović (1978)'s theory that cave-dwelling hunter-gatherers first introduced pottery to the region. Here, we review how far these ideas have been confirmed by the last three decades of research.

1 Pokrovnik, Vrbica, Pećini u Brini, Tradanj, Danilo Bitinj, Krcina Klis, Markova špilja, Samograd II and III, Jami na Sredi, Vela špilja, Vorganska peć, Vela Gromača,

Verudnica, Šandalja, Vižula, Nin, Smilčić, Debeljak, Vrčin, and Le Macchie (Müller 1994, plates 1–69, 75, 76).

THE EVIDENCE

East Adriatic Neolithic pottery

Johannes Müller was realistic about how fine-grained a typo-chronology could be obtained, considering both the nature of Neolithic sites in the eastern Adriatic, and how they were excavated (Müller 1991), so that find-spots could only optimistically be regarded as closed contexts. However, about 20% of early Neolithic sherds were decorated, with at least 86 recognisable motifs, and often more than one motif on the same sherd. Seriation of these motifs (by correspondence analysis, supported by stratigraphy and radiocarbon dates) allowed him to define four typo-chronological phases (A, B1, B2, C; Müller 1991), which was reduced to A, B and C for wider applicability (although Istrian and Bosnian assemblages each formed distinctive typological clusters).

Little archaeometric research had been undertaken on IW ceramic technology at the time, or until Michela Spataro's (2002) doctorate on Early, Middle and Late Neolithic pottery from both Adriatic coasts. Various Croatian archaeologists supplied sherds for her project, including Šime Batović, who excavated many Neolithic sites (e.g. Batović 1966; 1978). Šime Batović commented that IW contained abundant limestone, some of it crushed and added to the clay as temper, as Müller himself had observed (Müller 1991). Since her research was published (Spataro 2002; 2009; 2017), three archaeometric studies have appeared based on material from Pokrovnik, Smilčić, Krivače and Danilo Bitinj, and focusing on pedology, geochemistry and the function of Middle Neolithic Danilo and *figulina* ware (Fadem 2009; Teoh *et al.* 2014; McClure *et al.* 2018a). By contrast, analyses of Impressed Ware ceramics from western Europe have received more attention (e.g. Capelli *et al.* 2017 and references therein; Gabriele *et al.* 2019).

Early Neolithic seafaring across the Adriatic is documented (Bass 1998), and flint exchange is attested between south-eastern Italy and northern Dalmatia (Čečuk 1970). Bifacial tranchets, probably from the Gargano promontory, were found at Markova špilja on Hvar (Forenbaher and Perhoč 2017). Although Dalmatian early Neolithic pottery shares styles and decorative motifs with pottery in south-eastern Italy, however, archaeometric analyses show that pottery was not traded between the two coasts in the early Neolithic (Spataro 2002). Pottery along the Croatian coast was produced using mainly calcareous clays, sometimes tempered with crushed sparry calcite (Fig. 1), in contrast to the

use of non-calcareous clays, tempered with local sand and rock fragments, on the Italian coast (*ibid.*). Geochemistry shows clear separation between Impressed Ware fabrics from eastern Italy and the Dalmatian coastline (Fig. 2) — and incidentally, supports (Müller 1991)'s observation that IW from Vižula, in Istria, was unusual for its quartz sand content.

Radiocarbon dating

Sixteen radiometric (β -decay counting) ^{14}C dates, from seven East Adriatic IW sites, were known in the early 1990s. The sample material was usually unidentified bulk charcoal, whose date may be misleading, due to intrinsic age ('old wood effect') and the risk of combining fragments with different tree-fall dates. Over the next decade, the data set approximately doubled, with new radiometric dates from sites in Albania, northeast Italy and Istria (Petruso *et al.* 1994; Harrold *et al.* 1999; Biagi and Spataro 2000). Since 2007, 130 AMS (Accelerator Mass Spectrometry) dates have been published (Table 1), and the median uncertainty has fallen from ± 100 before the first AMS dates (Moore *et al.* 2007) to ± 36 by 2023 (Fig. 3).² Almost 60 new AMS dates were published in 2013–2014, in syntheses by Stašo Forenbaher *et al.* (2013), Sarah McClure *et al.* (2014), Emil Podrug *et al.* (2014), and Marc Vander Linden *et al.* (2014). Others have appeared in site-specific publications (Bass 2004; Mlekuž *et al.* 2008; Marijanović 2009; 2012; 2022; Podrug 2010; Budja *et al.* 2013; Horvat 2015; Podrug *et al.* 2018; Sirovica *et al.* 2021) and specialist studies (Jerbić Percan 2012; McClure *et al.* 2018a; 2022; Mathieson *et al.* 2018; Borić *et al.* 2019; Sierra *et al.* 2023). There are now over 160 plausible dates, mostly on identified, short-lived single organisms, from 35 sites, including IW, Danilo and Hvar phases.

In parallel, since the mid-1990s free software has facilitated calibration of ^{14}C ages and manipulation of ^{14}C data sets. Calibration curves have been updated regularly (Reimer *et al.* 2020), but the underlying ^{14}C data for the mid-Holocene period have barely changed since Minze Stuiver *et al.* (1998). The widespread use of OxCal (Bronk Ramsey 1995; 2001; 2009a) has changed how ^{14}C dates are interpreted: whereas Stašo Forenbaher and Preston Miracle (2005) and earlier authors based narratives on visual inspection of calibrated dates, it has become routine to use Bayesian

2 One calibrated ^{14}C date from Vela Spila, Wk-24218, was reported without its ^{14}C age (Rainsford *et al.* 2014) and is not included in this calculation.

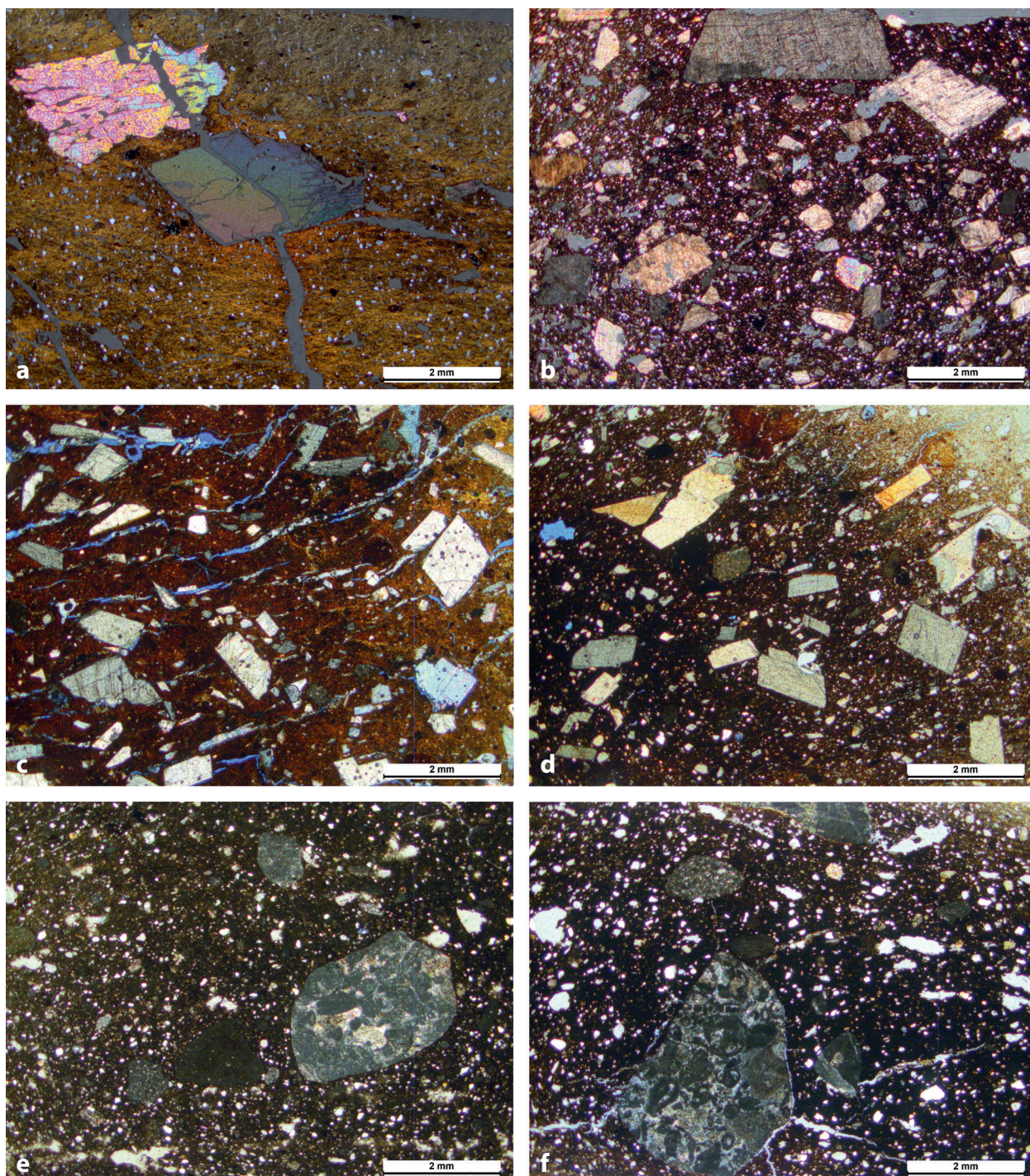
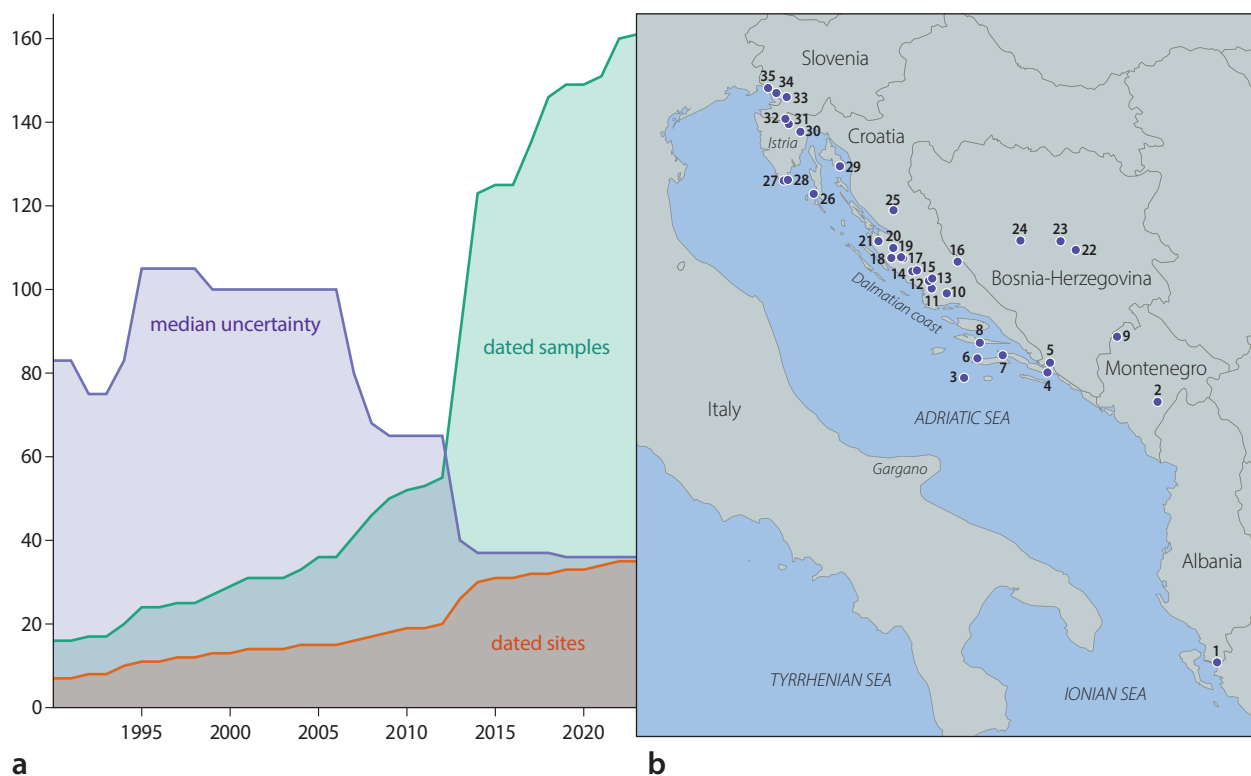


Fig. 1. Photomicrographs of thin sections of IW pottery from **a** Vela Jama (cave site, also known as Vela Spilja, sample VJ1, see Müller 1994, plate 54:11 [IW A-B]; **b** Jamina Sredi (cave site, sample INS8 [IW B]); **c** Konjevrate (open air site, sample KNV15 [IW A]; **d** Vrbica (open-air site, sample VRB13 [IW A]), Smilčić (open air site, sample SML18 [IW B-C]), and Tinj-Podlivade (open-air site, sample TN4 [IW B]). Samples **a–d** show crushed sparry calcite, whereas samples **e** and **f** show fossiliferous limestone, which might occur naturally in the clay (Photomicrographs taken in cross polarised light; graphic: Michela Spataro).



Fig. 2. Principal Components Analysis scatterplot of SEM-EDX geochemical data (major and minor oxides) of IW pottery at sites on both sides of the Adriatic. Each point represents the mean of bulk analyses of 4–5 spots on a single sherd (figure created using PAST4.17 [Hammer et al. 2001, with data from samples described in Spataro 2002]).



chronological modelling to refine date ranges for sites and wider archaeological phenomena, both in the East Adriatic (Forenbaher *et al.* 2013; McClure *et al.* 2014; Guiry *et al.* 2017; Borić *et al.* 2019) and in adjacent regions (e.g. Whittle *et al.* 2016; Meadows 2019). However, despite growing recognition that, due to taphonomic processes, some ^{14}C samples are probably not contemporaneous with diagnostic sherds (e.g. Mlekuz *et al.* 2008; Forenbaher *et al.* 2013; Borić *et al.* 2019), published models do not make use of outlier modelling

(Bronk Ramsey 2009b). There has been little interest in using aggregated ^{14}C dates as a demographic proxy in the East Adriatic, in contrast to nearby regions (Palmisano *et al.* 2017; Porčić *et al.* 2016; 2021). Eóin Parkinson *et al.* (2021) aggregated dates from the western Balkans, including the Adriatic but also inland areas with different ceramic traditions; as their source was RADON (Hinz *et al.* 2012), which in 2023 held almost none of the East Adriatic dates published after 2000, the observed pattern may be irrelevant.

DISCUSSION

We use OxCal's KDE_Model and KDE Plot functions to summarise the calibrated dates (Bronk Ramsey 2017) and to look for temporal patterns in the number of dated samples and sites (Fig. 4). A much earlier date for IW in southeast Italy is no longer tenable; only a handful of radiometric samples, all dated over 40 years ago, appear to date to the 7th millennium BCE, while all AMS samples date from c. 6000 cal BC onwards. A model of the 165 ^{14}C dates collated by Eóin Parkinson and Rowan McLaughlin (2020) yields an almost identical date for the first pottery in southeast Italy as in Dalmatia. Thus the ^{14}C evidence does not even exclude that the east Adriatic was the source of the Apulian early Neolithic. Sonja Kačar (2021) accepted that an Italian origin for the East Adriatic Neolithic is possible, given the use of Gargano flint in Dalmatia, but preferred the more neutral interpretation that 'Neolithic settlers, originating probably from Greece, established their colonies in Dalmatia and Apulia around 6000 cal BC'.

Dates associated with East Adriatic IW from cave sites span exactly the same range as dates from open-air sites (Fig. 4), so John Chapman and Johannes Müller (1990) were right to reject the idea that cave-dwellers introduced pottery to the region. Nevertheless, more of the ^{14}C dates from cave sites fall in the early 6th millennium, which may show a shift in the economy after c. 5800 cal BC (the high frequency of samples dating to the first quarter of the 6th millennium BCE may thus reflect a research focus on caves).

There is scant evidence of a south-north gradient in the dates, beyond the fact that the first Neolithic sites in Dalmatia are clearly earlier than those in Istria. The only ^{14}C date from Vela Spilja, Lošinj (Fig. 3, site 26) could be as old as any from the south Dalmatian islands, and implies a faster diffusion of pottery on the Dalmatian coast than we can presently measure, even with AMS precision. The 'earliest' dates from sites in the south and east are old radiometric measurements, however, and the Vela Spilja date appears earlier than any other AMS IW date, which raises the question of whether the sample was really associated with the Neolithic occupation. Thus, the situation is currently inconclusive.

It is also difficult to test Johannes Müller (1991)'s proposed dating of the IW typochronological sequence. The anomalously early Vela Spilja date is one of very few attributed to one type (IW A). Stašo Forenbaher *et al.* (2013) found that while the Nakovana stratigraphy supported an IW A-B sequence, ^{14}C dating showed no real difference in date, and that the other two dates then available that were clearly associated with either IW A or IW B also did not show a sequence. The five dates from Konjevrate (IW A) (McClure *et al.* 2018a) span the whole 6th millennium, and other IW dates have been published without exact typological associations (Table 1, Appendix). It would be a major undertaking to classify the pottery from these sites in order to use their dates in a typochronological model, or to date undated assemblages classified by Johannes

Fig. 3 (left page). **a** cumulative counts of published ^{14}C dates from East Adriatic Neolithic sites (green), and Neolithic sites with ^{14}C dates (red), and median 1-sigma error of cumulative data (purple, in ^{14}C years), 1990–2023 CE; **b** map of East Adriatic sites with published Neolithic ^{14}C dates (created in QGIS). Site numbers, which correspond to those in Table 1, Appendix: 1 Konispol; 2 Vruća cave; 3 Sušac; 4 Gudnja pećina; 5 Žukovička pećina; 6 Vela Spila, Korčula; 7 Nakovana; 8 Grapčeva; 9 Zemunica; 10 Škarin Samograd; 11 Danilo-Bitinj; 12 Konjevrate; 13 Pokrovnik; 14 Čista Mala Velistak; 15 Rašinovac; 16 Gospodska pećina; 17 Polje niže Vrcelja; 18 Tinj-Podlivade; 19 Barice; 20 Smilčić; 21 Crno vrilo; 22 Obre I; 23 Odmut; 24 Krivace; 25 Đurđeva greda; 26 Vela Spilja (also called Vela Jama), Lošinj; 27 Vižula (Medulin); 28 Kargadur; 29 Vorganjska; 30 Pupičina; 31 Vela peć; 32 Jačmica; 33 Mala Triglavca; 34 Ciclami; 35 Edera.

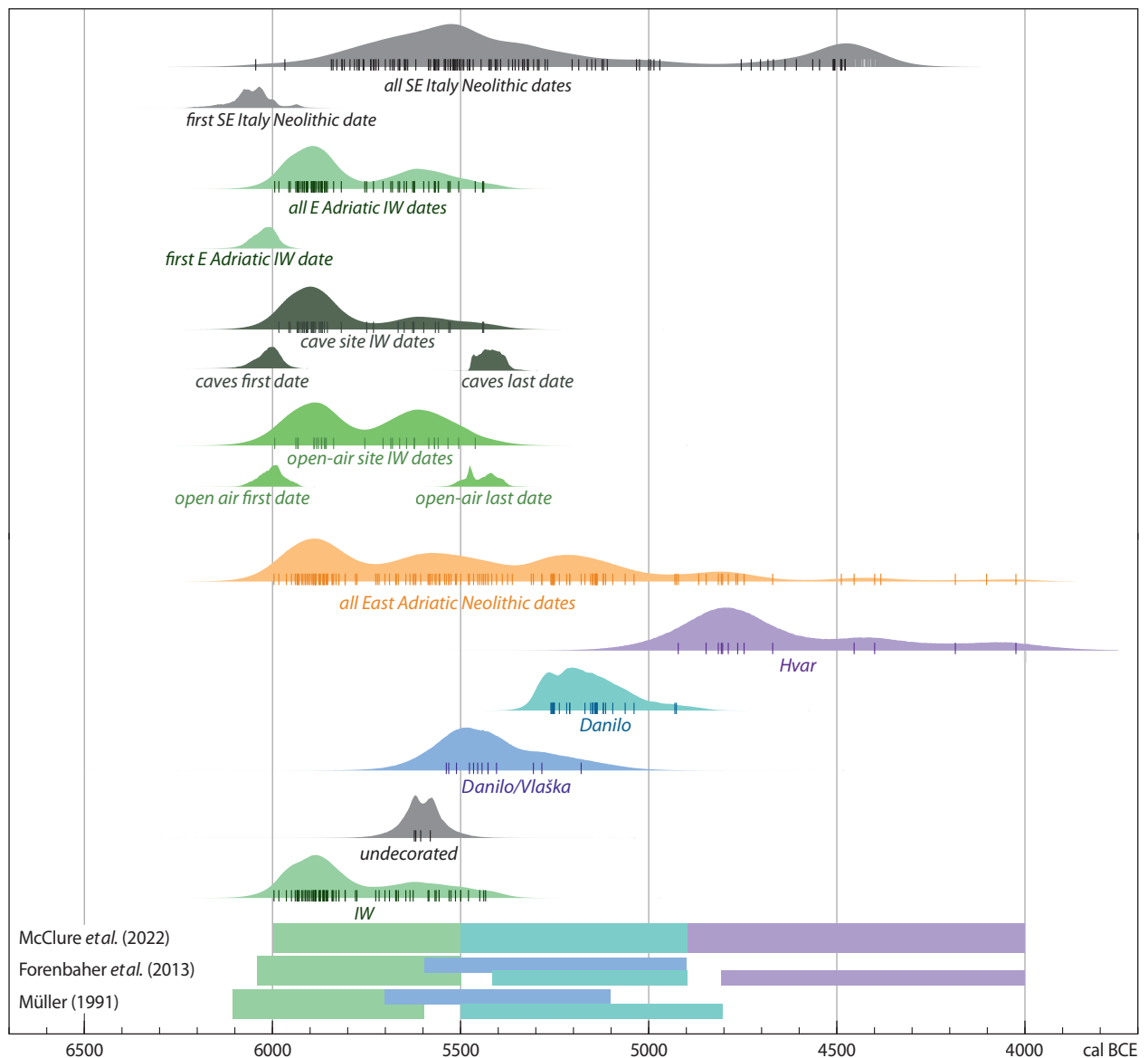


Fig. 4. Output of chronological modelling in OxCal v4 (Bronk Ramsey 2009a). The coloured distributions are kernel-density estimates of the temporal distribution of samples thought to be associated with each pottery or site type, using the data listed in Table 1 (Appendix) for the East Adriatic and Eóin Parkinson and T. Rowan McLaughlin (2020) for SE Italy. The vertical bars, showing the median modelled date of each sample, indicate how many dated samples are included in each KDE_Model or KDE_Plot. The OxCal First and Last functions estimate the date of the oldest and latest samples in each KDE_Model or KDE_Plot. The horizontal bands indicate the expected date ranges for corresponding pottery types according to various authors.

Müller (1994) (e.g. Vrbica, IW A; Jamina Sredi, IW B). When dated assemblages include more than one type (e.g. Smilčić has IW B and C), detailed contextual analysis might show which types ^{14}C dates are associated with. Stratigraphy can also reveal problematic associations (e.g. at Pokrovnik, dated cereal grains appear to have moved up or down the profile (McClure *et al.* 2014), so the same may apply to pottery, and the layer 19 *figulina* sherd may not predate Danilo).

Pottery technology is regarded as more conservative than typology, as the *chaîne opératoire* consists of a series of essential steps learned by repetitive practice, which can be used to make an almost unlimited range of shapes and decorations. Neolithic potters used the same *chaîne opératoire*, from the first appearance of IW to the Danilo and Hvar periods (Spataro 2002; 2017). Most vessels were made using clay tempered with crushed sparry calcite and possibly in rare cases,

limestone,³ and low-fired, almost always below 750°C, despite variations in shapes, surface treatments, decorative designs and motifs. Pottery from assemblages attributed to the earliest IW, such as Vrbica (IW A; Müller 1994, 322) and Konjevrate, both open air sites, and Vela Jama,⁴ a cave site on Lošinj Island (IW A-B, *ibid.*, 316), was made by the same methods used for later assemblages, such as Vižula (IW B and C; *ibid.*, 313), Smilčić (IW B and C) and Tinj-Podlivade (IW B; *ibid.*, 321), all open air sites, and Jamina Sredi (IW B; *ibid.*, 313), a cave site on Cres. No technological difference is visible between pottery from open air and cave sites (e.g. see Fig. 1). The amount and ubiquity of calcite temper seems to have increased over time (as first observed at Pokrovnik by Johannes Müller (1991, 323), particularly when comparing IW to Danilo and Hvar assemblages (Spataro 2017).

Most authors accept Johannes Müller's view that East Adriatic IW began just before 6000 calBC and lasted only until the mid-6th millennium BCE. Of only four late-6th millennium dates attributed to IW, two (Tinj, Vižula) were already available in 1990. A bone from Konjevrate (PSU-5557/UCIAMS-119838) and another from Vorganjska (Beta-479247) dated subsequently presumably belong to the Danilo phase. The last dates apparently associated with IW, at Žukovička pećina (Vander Linden *et al.* 2014), probably fall just before 5400 calBC. The latest periodization of the Dalmatian Neolithic (McClure *et al.* 2022) is almost unchanged from Stašo Forenbaher *et al.* (2013), and essentially agrees with Johannes Müller (1991; Fig. 4).

Istria and the Karst fit uneasily in this scheme, with scant evidence of IW, and clear evidence of Vlaška-style Danilo pottery before 5500 calBC. Rather than positing a temporal overlap between IW and Danilo-Vlaška pottery in the northern Adriatic (Sirovica *et al.* 2021),

we see a potential gap between IW and Danilo pottery in Dalmatia at c. 5400–5300 calBC (Fig. 4). One possibility is that IW and Danilo were separated by a phase of undecorated pottery, although this is not yet visible in the ¹⁴C dates. Three dates are associated with undecorated pottery in Dalmatia, from Đurđeva greda and Nakovana. Elsewhere (e.g. Gospodska pećina), dates could be associated with IW, undecorated pottery or both. At Edera cave and Mala Triglavca, in Istria, the first pottery is undecorated (Budja *et al.* 2013), but the only date for this material at Edera has a large uncertainty, and it is unclear which, if any, of the eleven 6th-millennium dates at Mala Triglavca are associated with undecorated or Danilo-Vlaška pottery.

If there is a gap between the end of IW and the beginning of Danilo in Dalmatia, it probably coincides with a gap between the latest Starčevo and the earliest Vinča dates in the central Balkans (Meadows 2019). This is unexpected, as Early Neolithic IW and Starčevo groups seem to have developed independently, and the same is true of the Middle Neolithic Danilo and Vinča groups (see Spataro 2017; 2019).

Almost all Danilo dates are older than Hvar dates, and the few exceptions are much later. Disregarding OxA-18172 (Kargadur) and OxA-18229 (Vela pec), Hvar pottery appears to have rapidly replaced Danilo at the start of the 5th millennium BCE (Fig. 4). Most Hvar dates are concentrated in the early 5th millennium, but there is a long tail of four later dates, extending to c. 4000 calBC. All the earlier dates are from Čista Mala Velistak, however, and all the later dates are from Nakovana, so the distribution of dates might simply reflect research history. The Neolithic-Copper Age transition is poorly dated, and this has not changed since the Nakovana dates were published (Forenbaher *et al.* 2013).

CONCLUSION

Johannes Müller's research on IW (Müller 1994) remains the major work on this topic for the eastern Adriatic, and its conclusions are still widely accepted. Thirty years ago, no archaeometric analyses of IW ceramics had been conducted. Michela Spataro (2002) showed that although pottery was not exchanged between the two Adriatic coasts, it was made following a consistent *chaîne opératoire*. In the eastern Adriatic, the same technology was used to make IW ceramics found in caves and open-air sites, and for the

different typochronological groupings Müller defined. With the exception of highly fired *figulina* ware, this *chaîne opératoire* persisted with the production of Middle-Late Neolithic Danilo and Hvar pottery (Spataro 2009; 2017; Teoh *et al.* 2014).

Despite rapid growth in the quantity and quality of ¹⁴C data from eastern Adriatic Neolithic sites, particularly over the last decade, Johannes Müller's chronology has not been radically adjusted (although earlier dates for IW in southeastern Italy have been

3 Limestone is often present in the ceramic thin sections (Spataro 2002), but it is hard to tell whether it was added as temper, or naturally present in the clay, as it is naturally

abundant in the samples collected close to the sites.

4 Also called "Vela špilja" (see Müller 1994, plates 51–53).

abandoned). The new evidence supports Müller's view that pottery was not adopted earlier at cave sites than at open-air sites, and that there was a significant delay between the first pottery in southern Dalmatia and its appearance in Istria, but does not allow us to test his typochronological subdivisions of IW. With better

¹⁴C precision and increasing spatio-temporal coverage, we can see peaks and troughs in the number of dates, and a possible gap between Early and Middle Neolithic on the eastern Adriatic coast, coinciding with a possible Early-Middle Neolithic gap in the central Balkans, which invites further research.

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APPENDIX

Table 1 (double page, continued on the following pages). East Adriatic Neolithic ¹⁴C dates.

Mapno.	Site	Type	Lat. N	Long. E	Cultural attribution	Material	Taxon
1	Konispol	Cave	39.68	20.18	Impressed Ware	Unknown	
1	Konispol	Cave	39.68	20.18	Impressed Ware	Unknown	
1	Konispol	Cave	39.68	20.18	Early/Middle Neolithic	Unknown	
2	Vruća cave	Cave	42.51	19.32	Impressed Ware	Antler	Red deer
2	Vruća cave	Cave	42.51	19.32	Impressed Ware	Antler	Red deer
3	Sušac	Open	42.76	16.53	Impressed Ware A	Charcoal	<i>Rhamnus</i>
3	Sušac	Open	42.76	16.53	Unknown	Unknown	Unknown
4	Gudnja pecina	Cave	42.82	17.73	Impresso-Danilo	Charcoal	Unknown
4	Gudnja pecina	Cave	42.82	17.73	Impressed Ware	Charcoal	Unknown
4	Gudnja pecina	Cave	42.82	17.73	Impressed Ware	Charcoal	Unknown
5	Žukovička pećina	Cave	42.92	17.77	Impressed Ware	Bone	Animal
5	Žukovička pećina	Cave	42.92	17.77	Impressed Ware	Bone	Animal
6	Vela Spila, Korčula	Cave	42.97	16.72	Impressed Ware	Unknown	
6	Vela Spila, Korčula	Cave	42.97	16.72	Impressed Ware	Unknown	
7	Nakovana	Cave	43.00	17.08	Impressed Ware	Charcoal	<i>Juniperus</i>
7	Nakovana	Cave	43.00	17.08	Impressed Ware	Charcoal	<i>Juniperus</i>
7	Nakovana	Cave	43.00	17.08	Impressed Ware	Charcoal	<i>Pinus</i>
7	Nakovana	Cave	43.00	17.08	Undecorated	Charcoal	<i>Prunus</i>
7	Nakovana	Cave	43.00	17.08	Undecorated	Charcoal	<i>Prunus</i>
7	Nakovana	Cave	43.00	17.08	Danilo	Charcoal	<i>Rhamnus</i>
7	Nakovana	Cave	43.00	17.08	Danilo polychrome	Charcoal	<i>Quercus</i>
7	Nakovana	Cave	43.00	17.08	Danilo Southern Dalmatian polychr.	Charcoal	<i>Ulex</i>
7	Nakovana	Cave	43.00	17.08	Hvar (outlined)	Charcoal	<i>Rhamnus</i>
7	Nakovana	Cave	43.00	17.08	Hvar (classic)	Charcoal	<i>Rhamnus</i>

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Method	Lab code	C/N	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	^{14}C age BP	^{14}C σ	Source / publication
β -count	Beta-56415				7060	110	Petruso <i>et al.</i> 1994; Harrold <i>et al.</i> 1999
β -count	Beta-56416				6800	140	Petruso <i>et al.</i> 1994; Harrold <i>et al.</i> 1999
β -count	Beta-67802				6830	80	Harrold <i>et al.</i> 1999
AMS	OxA-28274	3.30	–19.50	1.30	6969	33	Borić <i>et al.</i> 2019
AMS	OxA-32282	3.20	–19.90	2.40	6902	35	Borić <i>et al.</i> 2019
AMS	ETH-22912				6925	65	Bass 2004
AMS	ETH-22913				5895	65	Della Casa 2019
β -count	GrN-10311				6560	40	Chapman and Müller 1990
β -count	GrN-10314				6935	50	Chapman and Müller 1990
β -count	GrN-10315				7170	70	Chapman and Müller 1990
AMS	OxA-23599				6437	35	Vander Linden <i>et al.</i> 2014
AMS	OxA-23600				6466	34	Vander Linden <i>et al.</i> 2014
β -count	Z-1967				7300	120	Čečuk and Radić 2001
β -count	Z-1968				7000	120	Čečuk and Radić 2001
AMS	OxA-18120				7050	37	Forenbaher <i>et al.</i> 2013
AMS	OxA-18121				6982	36	Forenbaher <i>et al.</i> 2013
AMS	OxA-18122				6975	37	Forenbaher <i>et al.</i> 2013
AMS	OxA-18123				6711	36	Forenbaher <i>et al.</i> 2013
AMS	OxA-18124				6609	37	Forenbaher <i>et al.</i> 2013
AMS	OxA-18125				6236	35	Forenbaher <i>et al.</i> 2013
AMS	OxA-18126				6117	34	Forenbaher <i>et al.</i> 2013
AMS	OxA-18127				6004	34	Forenbaher <i>et al.</i> 2013
AMS	OxA-18173				5631	31	Forenbaher <i>et al.</i> 2013
AMS	OxA-18174				5547	33	Forenbaher <i>et al.</i> 2013

Table 1 (double page, continued on the following pages). East Adriatic Neolithic ¹⁴C dates.

Mapno.	Site	Type	Lat. N	Long. E	Cultural attribution	Material	Taxon
7	Nakovana	Cave	43.00	17.08	Hvar (late)	Charcoal	<i>Fraxinus</i>
7	Nakovana	Cave	43.00	17.08	Hvar (late)	Charcoal	<i>Prunus</i>
8	Grapčeva	Cave	43.13	16.75	Impressed Ware	Unknown	
8	Grapčeva	Cave	43.13	16.75	Hvar (classic)	Bone	Human
8	Grapčeva	Cave	43.13	16.75	Hvar (classic)	Bone	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, sacrum	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, talus (r)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, talus (l)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, talus (r)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, clavicle (r)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, clavicle (l)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, clavicle (l)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, clavicle (l)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, clavicle (r)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone, clavicle (r)	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone	Human
9	Zemunica	Cave	43.20	18.73	Impressed Ware	Bone	Human
10	Škarin Samograd	Cave	43.65	16.28	Impressed Ware	Bone	Unknown
10	Škarin Samograd	Cave	43.65	16.28	Impressed Ware	Bone	Unknown
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Bone	Sheep
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Grain	Einkorn
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Grain	Emmer
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Grain	Emmer
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Grain	Einkorn
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Grain	Einkorn
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Grain	Einkorn
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Grain	Einkorn
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Seed	Rose
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Seed	Rose
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Seed	Rose
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Seed	Rose
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Seed	Rose
11	Danilo-Bitinj	Open	43.70	16.06	Danilo	Bone	Sheep
12	Konjevrate	Open	43.78	16.02	Impressed Ware A	Bone	Sheep
12	Konjevrate	Open	43.78	16.02	Impressed Ware A	Bone	Sheep
12	Konjevrate	Open	43.78	16.02	Impressed Ware A	Bone, mandible (r)	Cattle
12	Konjevrate	Open	43.78	16.02	Impressed Ware A	Bone	Large mammal
12	Konjevrate	Open	43.78	16.02	Impressed Ware A	Bone, femur	Goat
13	Pokrovnik	Open	43.81	16.07	Danilo	Seeds	
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Grain	Einkorn
13	Pokrovnik	Open	43.81	16.07	Danilo	Grain	Emmer
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Grain	Emmer
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Grain	Emmer
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Grain	Einkorn
13	Pokrovnik	Open	43.81	16.07	Danilo	Grain	Emmer
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Grain	Emmer
13	Pokrovnik	Open	43.81	16.07	Danilo	Bone	Sheep
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Bone	Sheep
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Bone	Cattle
13	Pokrovnik	Open	43.81	16.07	Danilo	Bone	Cattle
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Bone	Sheep
13	Pokrovnik	Open	43.81	16.07	Danilo	Bone	Cattle
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Bone	Cattle

Method	Lab code	C/N	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	^{14}C age BP	^{14}C σ	Source / publication
AMS	OxA-18175				5190	30	Forenbahe <i>et al.</i> 2013
AMS	OxA-18176				5357	30	Forenbahe <i>et al.</i> 2013
AMS	Beta-103488				7030	60	Forenbahe and Kaiser 1999
AMS	OxA-18177				5867	31	Forenbahe <i>et al.</i> 2013
AMS	OxA-18178				5796	30	Forenbahe <i>et al.</i> 2013
AMS	MAMS-14621	3.20	-19.90	9.00	7006	29	Guiry <i>et al.</i> 2017
AMS	MAMS-14622	3.30	-20.00	7.80	7035	29	Guiry <i>et al.</i> 2017
AMS	MAMS-14623	3.30	-20.10	8.10	6962	29	Guiry <i>et al.</i> 2017
AMS	MAMS-14624	3.30	-20.00	8.70	7008	25	Guiry <i>et al.</i> 2017
AMS	MAMS-14625	3.20	-20.10	8.50	7005	26	Guiry <i>et al.</i> 2017
AMS	MAMS-14626	3.10	-19.90	9.20	7070	26	Guiry <i>et al.</i> 2017
AMS	MAMS-14627	3.30	-19.80	7.90	7039	26	Guiry <i>et al.</i> 2017
AMS	MAMS-14628	3.20	-20.10	8.10	6996	26	Guiry <i>et al.</i> 2017
AMS	MAMS-14629	3.10	-20.10	7.90	7060	26	Guiry <i>et al.</i> 2017
AMS	MAMS-14630	3.20	-19.70	9.30	7054	26	Guiry <i>et al.</i> 2017
AMS	PSUAMS-2223	3.16	-20.52	8.75	7000	40	Mathieson <i>et al.</i> 2018
AMS	PSUAMS-2224	3.13	-19.57	11.64	7030	40	Mathieson <i>et al.</i> 2018
AMS	PSUAMS-2259	3.24	-20.25	8.79	6970	35	Mathieson <i>et al.</i> 2018
β -count	Hd-11950				6780	50	Chapman and Müller 1990
β -count	Hd-11952				6600	100	Chapman and Müller 1990
AMS	OxA-14449				6284	40	Moore <i>et al.</i> 2007
AMS	OxA-15680				5987	35	Moore <i>et al.</i> 2007
AMS	OxA-15681				6180	34	Moore <i>et al.</i> 2007
AMS	OxA-15764				6226	37	Moore <i>et al.</i> 2007
AMS	OxA-15765				6245	39	Moore <i>et al.</i> 2007
AMS	OxA-17126				6237	37	Podrug <i>et al.</i> 2014
AMS	OxA-17196				6212	35	Podrug <i>et al.</i> 2014
AMS	OxA-17197				6121	37	Podrug <i>et al.</i> 2014
AMS	OxA-17198				6093	36	Podrug <i>et al.</i> 2014
AMS	OxA-17199				6103	37	Podrug <i>et al.</i> 2014
AMS	OxA-17200				6161	36	Podrug <i>et al.</i> 2014
AMS	OxA-17224				6083	35	Podrug <i>et al.</i> 2014
AMS	OxA-17329				6204	38	Podrug <i>et al.</i> 2014
AMS	PSU-5290/UCIAMS-116202				6155	25	McClure <i>et al.</i> 2014
AMS	PSU-5291/UCIAMS-116203				6655	25	McClure <i>et al.</i> 2014
AMS	PSU-5557/UCIAMS-119838				6175	30	McClure <i>et al.</i> 2014
AMS	PSUAMS-1431	3.26	-19.70	6.90	6985	30	McClure <i>et al.</i> 2018b
AMS	PSUAMS-1432	3.35	-20.50	6.80	6950	45	McClure <i>et al.</i> 2018b
AMS	PSUAMS-1433	3.29	-20.60	7.70	7000	30	McClure <i>et al.</i> 2018b
β -count	Hd-12842				6290	65	Biagi and Voytek 1996
AMS	OxA-17194				6999	37	Legge and Moore 2011
AMS	OxA-17124				6197	39	Podrug <i>et al.</i> 2014
AMS	OxA-17125				6568	36	Podrug <i>et al.</i> 2014
AMS	OxA-17193				6625	36	Podrug <i>et al.</i> 2014
AMS	OxA-17195				6626	39	Podrug <i>et al.</i> 2014
AMS	OxA-17223				6170	35	Podrug <i>et al.</i> 2014
AMS	OxA-17328				6810	40	Podrug <i>et al.</i> 2014
AMS	PSU-4960/ UCIAMS-106477				6280	20	McClure <i>et al.</i> 2014
AMS	PSU-4961/ UCIAMS-106478				6840	25	McClure <i>et al.</i> 2014
AMS	PSU-5293/UCIAMS-116205				7090	25	McClure <i>et al.</i> 2014
AMS	PSU-5294/ UCIAMS-116206				6190	25	McClure <i>et al.</i> 2014
AMS	PSU-5556/UCIAMS-119837				6975	30	McClure <i>et al.</i> 2014
AMS	PSU-6007/UCIAMS-140257				6165	25	McClure <i>et al.</i> 2018a
AMS	PSUAMS-3463				6735	30	McClure <i>et al.</i> 2018a

Table 1 (double page, continuation). East Adriatic Neolithic ¹⁴C dates.

Mapno.	Site	Type	Lat. N	Long. E	Cultural attribution	Material	Taxon
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Bone	Unknown
13	Pokrovnik	Open	43.81	16.07	Impressed Ware	Bone	Unknown
14	Čista Mala Velistak	Open	43.88	15.78	Hvar	Bone	Ovicaprid
14	Čista Mala Velistak	Open	43.88	15.78	Hvar	Bone	Ovicaprid
14	Čista Mala Velistak	Open	43.88	15.78	Hvar	Bone	Cattle
14	Čista Mala Velistak	Open	43.88	15.78	Hvar	Bone	Sheep
14	Čista Mala Velistak	Open	43.88	15.78	Hvar	Bone	Cattle
14	Čista Mala Velistak	Open	43.88	15.78	Hvar	Bone	Human
14	Čista Mala Velistak	Open	43.88	15.78	Hvar	Seed	Unknown
15	Rašinovac	Open	43.89	15.85	Impressed Ware	Bone, humerus	Cattle
15	Rašinovac	Open	43.89	15.85	Impressed Ware	Bone, vertebra	Goat
16	Gospodska pecina	Cave	43.98	16.43	Impresso & undecorated	Charcoal	Unknown
17	Polje niže Vrcelja	Open	44.02	15.65	Impressed Ware	Bone	Unknown
17	Polje niže Vrcelja	Open	44.02	15.65	Impressed Ware	Charcoal	Unknown
18	Tinj-Podlivade	Open	44.02	15.48	Impressed Ware B	Charcoal	Unknown
18	Tinj-Podlivade	Open	44.02	15.48	Impressed Ware B	Charcoal	Unknown
18	Tinj-Podlivade	Open	44.02	15.48	Impressed Ware B	Charcoal	Unknown
18	Tinj-Podlivade	Open	44.02	15.48	Impressed Ware	Bone	Sheep
19	Barice	Open	44.03	15.62	Danilo	Unknown	Unknown
19	Barice	Open	44.03	15.62	Danilo	Unknown	Unknown
20	Smilčić	Open	44.13	15.50	Impressed Ware	Bone	Human
20	Smilčić	Open	44.13	15.50	Impressed Ware	Bone	Human
21	Crno vrilo	Open	44.20	15.29	Impressed Ware monochrome	Bone	Unknown
21	Crno vrilo	Open	44.20	15.29	Impressed Ware monochrome	Bone	Unknown
21	Crno vrilo	Open	44.20	15.29	Impressed Ware monochrome	Bone	Unknown
21	Crno vrilo	Open	44.20	15.29	Impressed Ware monochrome	Bone	Unknown
22	Obre I	Open	44.10	18.14	Impresso & Starčevo	Unknown	Unknown
22	Obre I	Open	44.10	18.14	Impresso & Starčevo	Unknown	Unknown
22	Obre I	Open	44.10	18.14	Impresso & Starčevo	Unknown	Unknown
23	Odmut	Cave	44.19	17.92	Impresso & Starčevo	Charcoal	Unknown
23	Odmut	Cave	44.19	17.92	Impresso and Starčevo	Charcoal	Unknown
23	Odmut	Cave	44.19	17.92	Impressed Ware	Antler	Red deer
24	Krivace	Open	44.20	17.34	Danilo	Bone	Cattle
24	Krivace	Open	44.20	17.34	Danilo	Bone	Suid
24	Krivace	Open	44.20	17.34	Danilo	Bone	Human
24	Krivace	Open	44.20	17.34	Danilo	Bone	Human
24	Krivace	Open	44.20	17.34	Danilo	Bone	Human
24	Krivace	Open	44.20	17.34	Danilo	Bone	Unknown
24	Krivace	Open	44.20	17.34	Danilo	Bone	Unknown
24	Krivace	Open	44.20	17.34	Danilo	Bone	Unknown
24	Krivace	Open	44.20	17.34	Danilo	Bone	Unknown
25	Đurdeva greda	Open	44.51	15.51	Undecorated	Charcoal	Unknown
26	Vela Spilja (Vela Jama), Lošinj	Cave	44.68	14.36	Impressed Ware A and B	Charcoal	<i>Rhannus</i>
27	Vižula (Medulin)	Open	44.82	13.92	Impressed Ware B and C	Bone	Unknown
27	Vižula (Medulin)	Open	44.82	13.92	Impressed Ware B and C	Bone	Unknown
28	Kargadur	Open	44.83	13.98	Danilo-Vlaška	Bone	Suid
28	Kargadur	Open	44.83	13.98	Impressed Ware	Grain	Barley
28	Kargadur	Open	44.83	13.98	Impressed Ware	Grain	Barley
28	Kargadur	Open	44.83	13.98	Impressed Ware	Bone, petrous	Human
28	Kargadur	Open	44.83	13.98	Impressed Ware	Bone, petrous	Human
29	Vorganjska	Cave	44.96	14.73	Impressed Ware	Tooth	Cattle
29	Vorganjska	Cave	44.96	14.73	Danilo	Bone	Sheep/goat

Method	Lab code	C/N	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	^{14}C age BP	^{14}C σ	Source / publication
AMS	PSU-5617/UCIAMS-127399				6965	20	McClure <i>et al.</i> 2022
AMS	PSU-5618/UCIAMS-127400				6975	25	McClure <i>et al.</i> 2022
AMS	PSU-3701/UCIAMS-78155				5975	15	McClure <i>et al.</i> 2014
AMS	PSU-3702/UCIAMS-78156				5920	15	McClure <i>et al.</i> 2014
AMS	PSU-5288/UCIAMS-116200				6045	25	McClure <i>et al.</i> 2014
AMS	PSU-5289/UCIAMS-116201				5935	20	McClure <i>et al.</i> 2014
AMS	PSU-5563/5564/ UCIAMS-125829/125830				5903	11	McClure <i>et al.</i> 2014
AMS	PSU-5616/UCIAMS-127398				5945	20	McClure <i>et al.</i> 2014
AMS	PSUAMS-2045				5935	25	McClure <i>et al.</i> 2022
AMS	PSU-5612/UCIAMS-127394				7060	25	McClure <i>et al.</i> 2014
AMS	PSU-6492/UCIAMS-158546				7065	25	Podrug <i>et al.</i> 2018
β -count	Z-579				7010	90	Chapman and Müller 1990
AMS	Beta-293835				6480	50	Horvat 2015
AMS	Beta-293840				6520	40	Horvat 2015
β -count	GrN-15236				6980	160	Chapman and Müller 1990
β -count	GrN-15237				6670	260	Chapman and Müller 1990
β -count	GrN-15238				6280	210	Chapman and Müller 1990
AMS	ICA-14C-6145				6900	60	Sierra <i>et al.</i> 2023
AMS	Beta-327215				5900	30	Marijanović 2012
AMS	Beta-327216				6160	30	Marijanović 2012
AMS	Beta-471013		-18.70		6790	30	Marijanović 2022
AMS	Beta-471104		-19.60		6600	30	Marijanović 2022
AMS	Beta-222405				6500	60	Marijanović 2009
AMS	Beta-222406				6820	50	Marijanović 2009
AMS	Poz-18393				6900	40	Marijanović 2009
AMS	Poz-18395				6925	35	Marijanović 2009
β -count	Bln-636				6795	150	Chapman and Müller 1990
β -count	UCLA-16051				7200	60	Chapman and Müller 1990
β -count	UCLA-1605G				6710	60	Chapman and Müller 1990
β -count	SI-2223				6530	75	Chapman and Müller 1990
β -count	Z-412				6736	130	Chapman and Müller 1990
AMS	OxA-35001	3.20	-20.90	3.00	7035	36	Borić <i>et al.</i> 2019
AMS	PSU-5292/UCIAMS-116204				6300	25	McClure <i>et al.</i> 2014
AMS	PSU-5558/UCIAMS-119839				6115	30	McClure <i>et al.</i> 2014
AMS	PSU-5613/UCIAMS-127395				6270	20	McClure <i>et al.</i> 2014
AMS	PSU-5614/UCIAMS-127396				6285	20	McClure <i>et al.</i> 2014
AMS	PSU-5615/UCIAMS-127397				6290	20	McClure <i>et al.</i> 2014
AMS	PSU-5903/UCIAMS-135082				6215	20	Podrug <i>et al.</i> in press
AMS	PSU-5904/UCIAMS-135083				6210	20	Podrug <i>et al.</i> in press
AMS	PSU-5905/UCIAMS-135084				6305	20	Podrug <i>et al.</i> in press
AMS	PSU-6491/UCIAMS-158545				6260	25	Podrug <i>et al.</i> in press
AMS	Beta-293836				6710	50	Forenbaher and Vujnovic 2013
AMS	OxA-18118				7134	37	Forenbaher <i>et al.</i> 2013
β -count	Hd-11733				6140	65	Chapman and Müller 1990
β -count	Hd-12093				6850	180	Chapman and Müller 1990
AMS	OxA-18172				5686	33	Forenbaher <i>et al.</i> 2013
AMS	OxA-21092				6769	33	Forenbaher <i>et al.</i> 2013
AMS	OxA-21093				6612	32	Forenbaher <i>et al.</i> 2013
AMS	UCIAMS-174934				6720	20	Mathieson <i>et al.</i> 2018
AMS	UCIAMS-174935				6685	20	Mathieson <i>et al.</i> 2018
AMS	Beta-479247				6220	30	Sirovica <i>et al.</i> 2021
AMS	Beta-508328				5910	30	Sirovica <i>et al.</i> 2021

Mapno.	Site	Type	Lat. N	Long. E	Cultural attribution	Material	Taxon
30	Pupićina	Cave	45.32	14.16	Danilo/Vlaška	Unknown	
30	Pupićina	Cave	45.32	14.16	Danilo/Vlaška	Unknown	
30	Pupićina	Cave	45.32	14.16	Danilo/Vlaška	Unknown	
30	Pupićina	Cave	45.32	14.16	Danilo/Vlaška	Unknown	
30	Pupićina	Cave	45.32	14.16	Danilo-Vlaška	Charcoal	<i>Fraxinus</i>
30	Pupićina	Cave	45.32	14.16	Danilo-Vlaška	Charcoal	<i>Fraxinus</i>
31	Vela peć	Cave	45.39	14.00	Danilo-Vlaška	Charcoal	<i>Fraxinus</i>
32	Jačmica	Cave	45.45	13.95	Danilo-Vlaška	Charcoal	<i>Fraxinus</i>
32	Jačmica	Cave	45.45	13.95	Unknown	Charcoal	<i>Cornus/viburnum</i>
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Antler	Red deer
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Bone	Roe deer
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Bone	Roe deer
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Bone, scapula	Large ungulate
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Bone, skull	Human
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Unknown	
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Unknown	
33	Mala Triglavca	Cave	45.67	13.97	Misfit	Unknown	
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Unknown	
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Unknown	
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Unknown	
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Unknown	
33	Mala Triglavca	Cave	45.67	13.97	Misfit	Unknown	
33	Mala Triglavca	Cave	45.67	13.97	Unknown	Unknown	
34	Ciclami	Cave	45.71	13.82	Danilo/Vlaška	Unknown	
35	Edera	Cave	45.76	13.70	Danilo/Vlaška	Unknown	
35	Edera	Cave	45.76	13.70	Danilo/Vlaška	Unknown	
35	Edera	Cave	45.76	13.70	Danilo/Vlaška	Unknown	
35	Edera	Cave	45.76	13.70	Undecorated	Unknown	
35	Edera	Cave	45.76	13.70	Danilo/Vlaška	Unknown	
35	Edera	Cave	45.76	13.70	Danilo/Vlaška	Unknown	

Method	Lab code	C/N	$\delta^{13}\text{C}$ (‰)	$\delta^{15}\text{N}$ (‰)	^{14}C age BP	^{14}C σ	Source / publication
β -count	Z-2575				6600	240	Miracle 1997
AMS	Beta-131624				6270	120	Miracle and Forenbaheer 2005
AMS	Beta-131625				6680	100	Miracle and Forenbaheer 2005
AMS	OxA-8471				6495	60	Miracle and Forenbaheer 2005
AMS	OxA-18119				6516	36	Forenbaheer <i>et al.</i> 2013
AMS	OxA-18128				6606	36	Forenbaheer <i>et al.</i> 2013
AMS	OxA-18229				5409	33	Forenbaheer <i>et al.</i> 2013
AMS	OxA-18181				6191	31	Forenbaheer <i>et al.</i> 2013
AMS	OxA-18182				5263	31	Forenbaheer <i>et al.</i> 2013
AMS	OxA-15134				6602	37	Mlekuž <i>et al.</i> 2008
AMS	OxA-15139				6451	36	Mlekuž <i>et al.</i> 2008
AMS	OxA-15223				6647	37	Mlekuž <i>et al.</i> 2008
AMS	Poz-14243				5980	40	Mlekuž <i>et al.</i> 2008
AMS	Poz-16342				5120	40	Mlekuž <i>et al.</i> 2008
Unknown	Beta-23604				5530	60	Budja <i>et al.</i> 2013
AMS	Poz-21395				6320	40	Budja <i>et al.</i> 2013
AMS	Poz-48530				6390	40	Budja <i>et al.</i> 2013
AMS	Poz-48531				6960	170	Budja <i>et al.</i> 2013
AMS	Poz-48538				6410	40	Budja <i>et al.</i> 2013
AMS	Poz-48539				6340	40	Budja <i>et al.</i> 2013
AMS	Poz-48540				6620	40	Budja <i>et al.</i> 2013
AMS	Poz-48541				6400	40	Budja <i>et al.</i> 2013
AMS	Poz-48542				6940	40	Budja <i>et al.</i> 2013
AMS	Poz-48543				5660	40	Budja <i>et al.</i> 2013
β -count	R-1040A				6300	50	Gilli and Montagnari Kokelj 1992
β -count	GX-19022				6305	285	Biagi 1995
β -count	GX-19567				6445	210	Biagi 1995
β -count	GX-19568				6615	390	Biagi 1995
β -count	GX-19569				6700	130	Biagi 1995
β -count	GrN-23129				6590	100	Biagi and Spataro 2000
β -count	GrN-25474				6480	40	Biagi and Spataro 2000

Thinking Big – Reflections from Late Neolithic Southern Britain

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KEYWORDS: *scale, temporality, social context, monuments, change, thinking big*

Abstract

I pick up on recurrent questions of scale, temporality and social context raised across the spectrum of the work of Johannes Müller, and briefly assess the successes and remaining gaps in our understanding of the sequence of great building enterprises in the last two centuries or so of the Late Neolithic in southern Britain. This focuses attention on selected major monuments and their context in the 26th–24th centuries cal BC in central-southern England. Significant activity took place in both well established locales in the

landscape and new places. The possible emergent trajectory of development needs now to be confirmed by formal chronological modelling, and further detail of regional variation in the character and density of contemporary settlement should be explored. A more historical approach to unpicking individual settings and sequences should be the way ahead to navigate competing models of what was going on, and we should probably now be looking for multiple causes and circumstances in a rapidly changing wider world.

Zusammenfassung

Ich greife wiederkehrende Fragen zu Maßstab, chronologischer Einordnung und sozialem Kontext auf, die in der gesamten Arbeit von Johannes Müller aufgeworfen wurden, und bewerte kurz die Erfolge und verbleibenden Lücken in unserem Verständnis der Abfolge von Großmonumenten in den letzten zwei Jahrhunderten des Spätneolithikums in Südbritannien. Der Schwerpunkt liegt auf ausgewählten Bauwerken und ihrem Kontext im 26.–24. Jahrhundert v. Chr. in Mittel- und Südengland. Bedeutende Aktivitäten fanden sowohl an etablierten als auch an neuen Plätzen in der Landschaft statt. Der sich möglicherweise abzeichnende Ent-

wicklungsverlauf muss nun durch eine formale chronologische Modellierung bestätigt werden, und es sollten weitere Einzelheiten der regionalen Unterschiede in Bezug auf den Charakter und die Dichte gleichzeitig bestehender Siedlungen erforscht werden. Ein stärker historisch ausgerichteter Ansatz zur Aufschlüsselung einzelner Ereignisse und Sequenzen sollte der richtige Weg sein, um konkurrierende Modelle des Geschehens in den Griff zu bekommen, und wir sollten jetzt wahrscheinlich nach mehreren Ursachen und Umständen in einer sich rasch verändernden Welt suchen.

QUESTIONS OF SCALE, TEMPORALITY AND SOCIAL CONTEXT

Over decades, Johannes Müller has been at the forefront of research on Neolithic and Copper Age Europe. His geographical reach has been considerable, from northern parts of Germany to the Balkans and Ukraine. He has accomplished alike both targeted excavation of important sites — including the Bosnian tell of Okolište and the Trypillia mega-site of Maidanetske — and wide-ranging synthesis, with a

persistent interest in social relations and formations (from a much longer list, see Müller 2001; 2010; 2011; 2014; 2019; 2023; Müller *et al.* 2013; 2014; 2016; 2017; 2024). He has built up his department in Kiel as a hive of research activity and discussion, and both colleagues and PhD students have also published widely on related themes, often in close collaboration (for example, again from a much longer list, Hofmann *et al.* 2019;

2024). His own publications have been invariably detailed, and keenly aware of context and sequence. One of his early papers was on the implications of the sequence of tomb constructions in Orkney (Müller 1990), and Britain and Ireland remain in his wider frame of reference (for example Wunderlich *et al.* 2019, fig. 1, on Europe-wide trends in monument building).

So, in this short essay in tribute to the many achievements of Johannes, I want to pick up on recurrent ques-

tions of scale, temporality and social context raised across the spectrum of his work, and briefly to review selected major monuments and their context at the end of the Late Neolithic in southern Britain. That opens possibilities for comparisons elsewhere, and the end of my brief discussion will touch by way of comparison on other so-called mega-sites in Europe. That is not to try to construct universalising insights, as we shall see, but to aim at unpicking individual settings and sequences.

THE LATE NEOLITHIC IN BRITAIN

Currently, the Neolithic period in Britain is often divided into three parts. The Early Neolithic runs from probable beginnings at the end of the 5th millennium cal BC to around 3300 cal BC (Whittle *et al.* 2011); the Middle Neolithic is often put from *c.* 3300 to 2900 cal BC; and the Late Neolithic is often seen as spanning from *c.* 2900 to somewhere in the 25th century cal BC or the start of the 24th century cal BC, ending with the introduction of Beaker burials in England in the first half of the 24th century cal BC (Cummings 2017; Bradley 2019; Jay *et al.* 2019; Parker Pearson *et al.* 2019; Vander Linden 2024; Greaney and Whittle 2025). While useful in some ways, this is a somewhat clumsy system, which struggles to deal with both regional variation across Britain, and indeed Ireland, and temporal variation across these boundaries, the Grooved Ware phenomenon for example emerging it seems on current evidence in the 32nd century cal BC in Orkney (Copper *et al.* 2023) then spreading rapidly to other parts of Britain and remaining in use until the end of the Neolithic. Chronological precision is also uneven

across this structure, with much more formal chronological modelling available so far for the Early Neolithic (Whittle *et al.* 2011; 2022) than for the Middle and Late Neolithic. That situation is changing, with a current major project (Project TIME) covering the later 4th and 3rd millennia in much more detail (Seren Griffiths, pers. comm.; Griffiths *et al.* 2023), and with some individual Middle and Late sites now having much more precise date estimates (by way of initial examples, Gibson and Bayliss 2009; Bayliss *et al.* 2017a; Greaney *et al.* 2020; Marshall *et al.* 2024a; 2024b). The wider research goal must be to construct a detailed century-by-century account, and on down to the scale of generations and decades (and ideally to even greater precision: see Heaton *et al.* 2024), and one of the main aims of this paper is briefly to assess the successes and remaining gaps in our understanding of the sequence of great building enterprises in the last two centuries or so of the Late Neolithic in central-southern England.

HEROIC FEATS OF CONSTRUCTION IN THE LAST CENTURIES OF THE LATE NEOLITHIC IN SOUTHERN BRITAIN

The wider context

One of the recurrent features of the Late Neolithic in Britain is the wide repertoire of constructions including henges, stone circles, palisade enclosures and mounds, which must have required many people to build and which presumably drew together large gatherings for their ritual and other uses. The recent claim that the Altar Stone at Stonehenge may have been brought from north-east Scotland (Clarke *et al.* 2024; cf. Carlin and Cooney 2020) only adds to the impression that this was an age of heroic feats. I will concentrate here on some of the largest of these efforts, on a transect across central-southern England, from Avebury, Wiltshire, to Dorchester, Dorset (Fig. 1). In making such a selection for the purposes of this essay, we should not forget the widespread, but not ubiquitous,

distribution of these kinds of site across the country as a whole (Burl 1976; Wainwright 1989; Pitts 2011; Richards and Cummings 2024), and it may seem arbitrary to leave out of consideration other relevant sites and complexes not so far away from my chosen examples, such as those at Dorchester-on-Thames, Stanton Drew and Priddy (Whittle *et al.* 1992; Pitts 2011; Gillings *et al.* 2008, 209–10; Lewis and Mullin 2011). Indeed, as we shall see in discussion below, explanations of exceptional achievements must also take into account the wider context to which they belonged. Nor should we separate the late, great constructions and assemblies from their history. I will concentrate on outstanding examples which appear to concentrate in the 26th to the 24th centuries cal BC, but henges and stone circles probably go back to the 30th century cal BC (Bayliss *et al.* 2017a). It is my informal and

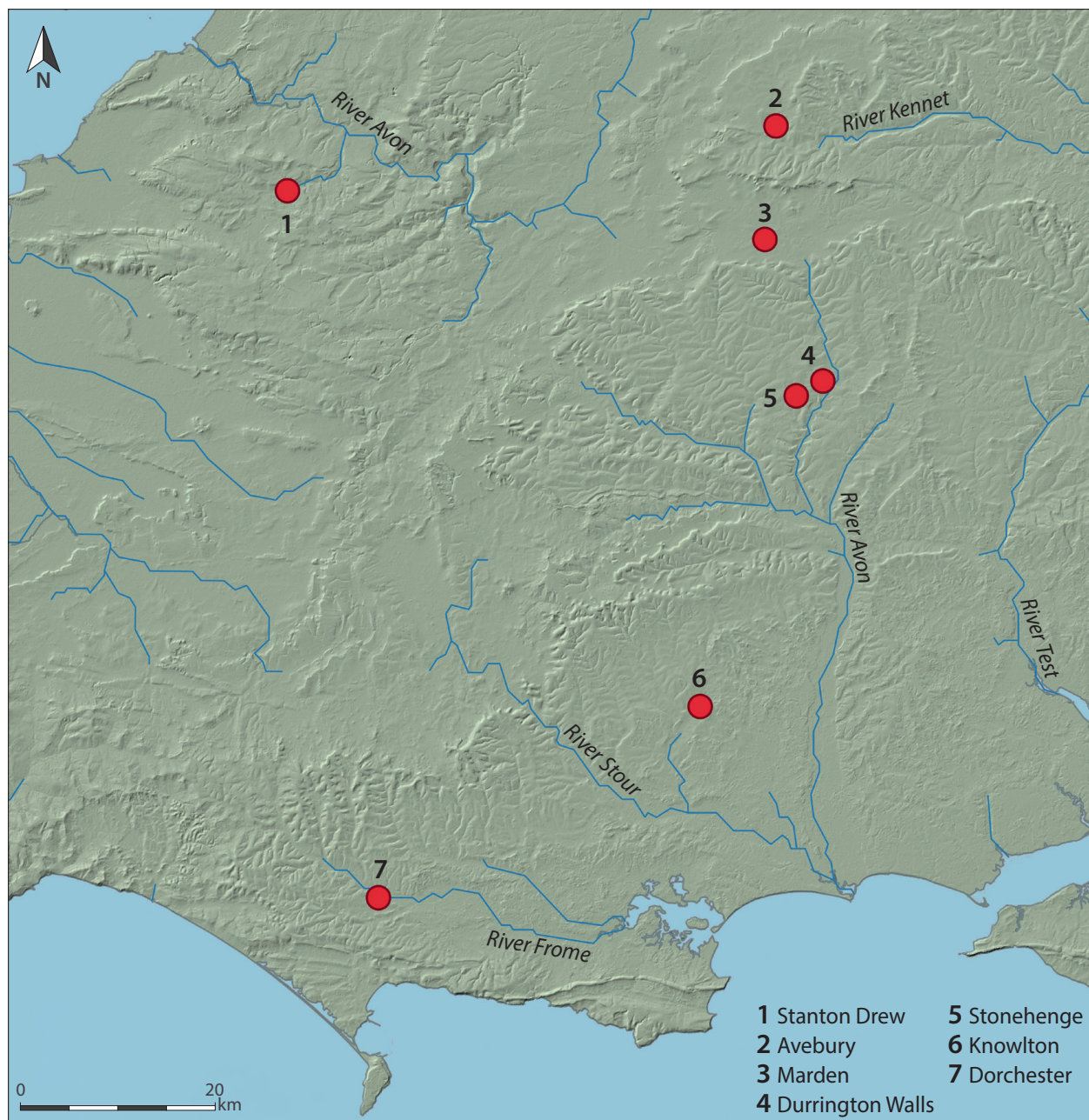


Fig. 1. Map showing the principal Late Neolithic monument complexes in central-southern England discussed in the text (Graphic: Michael Copper, after Gillings *et al.* 2008).

unmodelled impression that there were fewer constructions of this kind in the earlier centuries of the 3rd millennium, in contrast also to the concentrated activity in Orkney and eastern Ireland in the Middle Neolithic in the last centuries and the turn of the 4th millennium (Bayliss *et al.* 2017a; Card *et al.* 2020; Ness of Brodgar Trust 2024; Cooney 2023). If so, the widest explanations probably have to take into account a cyclical pattern of development and change. We will also come back to that in discussion below.

In each case I will briefly note the context, history and setting, then the scale of things, and finally but not least the available evidence for date and sequence, in an effort to assess the current state of research. My examples are then followed by brief remarks on the settlement context, and by discussion and comparisons.

Avebury

The Late Neolithic complex at Avebury belongs in an older landscape. The Early Neolithic saw numerous long barrows and two causewayed enclosures (Gillings and Pollard 2004; Gillings *et al.* 2008); it is telling that there could be an Early Neolithic feature at the heart of Avebury itself (Gillings *et al.* 2019). There are, however, no obvious major new constructions of the Middle Neolithic, though the first phase of the Avebury bank might go that far back (Gillings and Pollard 2004; Gillings *et al.* 2008). We looked for a cursus monument in the locality in 1993, without success (Whittle 1993).

The scale of things in the Late Neolithic has long been recognised as exceptional (Smith 1965) and has been enhanced by continuing research and discovery. To Avebury, with its considerable bank and ditch, outer stone circle (the largest of its kind), two inner stone circles and settings, and the connecting West Kennet Avenue (Gillings and Pollard 2004), has been added the Beckhampton Avenue to the west, confirmed by recent fieldwork, and the Longstones enclosure (Gillings *et al.* 2008; 2024). The diameter of the Avebury henge, like that of the other so-called mega-henges discussed here, is comfortably in excess of 300m (Wainwright 1989, 15). There remains no sign of avenues connected to the east or north entrances of Avebury. Renewed excavation at Silbury Hill has added a wealth of new understandings of its structure and development (Leary and Field 2010; Leary *et al.* 2013a). Excavation in the late 1980s and early 1990s confirmed the presence of the two West Kennet palisade enclosures (Whittle 1997); subsequent analysis of aerial photographs showed the presence of more connecting features (Barber 2003; Leary *et al.* 2013a, 234–235); and recent excavation by Joshua Pollard and Mark Gillings as part of the Living with Monuments project has done much to confirm and further investigate these. That work has also revealed evidence of material connections to eastern and north-east England (Cleal and Pollard 2023), and isotopic analysis of animal bone samples from West Kennet showed imports from off the chalk, some potentially from considerable distance (Madgwick *et al.* 2019). The Marlborough Mound a little to the east has been shown to have a substantial Late Neolithic core, at 18m about half the height of Silbury Hill (Leary *et al.* 2013b; Leary and Pollard 2022).

The dating of this impressive tally is improving but still far from perfect. I cite only the headlines, as there is so far a mixture, as for the other complexes below, of modelled and unmodelled results, and there is much scope still for further dating and modelling. We know that there is a first phase of bank construction at Avebury, but this is so far undated (Gillings and Pollard 2004; Pollard and Cleal 2004). The Avebury ditch,

and by association the main bank, seems firmly dated to the 26th century cal BC, and the main outer stone circle may well be of similar date, with subsequent alterations in the Beaker period (Pitts and Whittle 1992; Pollard and Cleal 2004; Healy 2016). Silbury Hill was initiated in the 25th century cal BC and completed in the 24th or 23rd century cal BC (Leary and Marshall 2012; Marshall *et al.* 2013). The Marlborough Mound also dates to the second half of the 3rd millennium (Leary and Marshall 2012, fig. 3; Leary and Pollard 2022). Dates from the West Kennet palisade enclosures initially suggested the same date span (Whittle 1997), though subsequent charcoal dates have indicated construction in the later 4th millennium, followed by later, Grooved Ware-associated occupation (Bayliss *et al.* 2017b); further dates are expected from the recent excavations by the Living with Monuments project (Josh Pollard, pers. comm.). The Longstones enclosure appears to date to the 29th–27th centuries cal BC (Gillings *et al.* 2008).

Marden

At first sight, the Vale of Pewsey seems a little used area, overlooked by the busier Avebury area and Salisbury Plain, but we know now of lithic scatters and at least one significant Early Neolithic long barrow at Cat's Brain (Leary *et al.* 2020). There are no certain Middle Neolithic monuments, if the large single-ditched enclosure at Crofton at the eastern end of the Vale belongs to the 3rd millennium (Whittle *et al.* 2011, 60, 96). The major henge at Marden, associated with Grooved Ware, and containing the former Hatfield Barrow, reputedly 15m high, thus appears as not only an impressively large monument (in fact the largest of the mega-henges) but also arguably as a Late Neolithic intake or consolidation of the area, perhaps along with a handful of other sites and monuments (Leary and Field 2012). The more recent further excavations should produce more dates in due course (*ibid.*; Wainwright 1989); the Hatfield Barrow was probably initiated in the 25th century cal BC (Leary and Marshall 2012). Imports of animals from distance have also been found by isotopic analysis (Madgwick *et al.* 2019).

Stonehenge

The Late Neolithic complex at Stonehenge belongs to a long-occupied landscape, with plenty of evidence of Early Neolithic (and indeed Mesolithic) activity in the vicinity; there are two causewayed enclosures and a notable concentration of long barrows (Whittle *et al.* 2011; Parker Pearson 2023a; 2023b; Parker Pearson *et al.* 2022). Middle Neolithic activity is represented

by the two known cursus monuments, and indeed, depending on the definition of the date span of the Middle Neolithic period, by the first phase of construction around 3000 cal BC at the Stonehenge monument itself (Darvill *et al.* 2012; Parker Pearson 2023a; 2023b; Parker Pearson *et al.* 2020).

The scale of Late Neolithic activity has long been recognised, since the time of the early antiquaries, and recent research has served dramatically to enhance this. This is all very well known and publicised (see also Ruggles and Chadburn 2024), so my account is deliberately brief and selective. Phasing now suggested for the Stonehenge monument itself suggests long-range connections from the start, with bluestones from south-west Wales potentially belonging to the first phase of construction; specific quarries in south-west Wales have been identified (Parker Pearson 2023a, with references). The specific source of most of the sarsens which are major elements of the phase 2 version of the monument probably in the middle of the 3rd millennium (Darvill *et al.* 2012; Parker Pearson 2023a; 2023b; Parker Pearson *et al.* 2020; and see below) has recently been identified some 30 km to the north near Marlborough (Nash *et al.* 2020). The newly suggested provenance of the Altar Stone in north-east Scotland, already noted, adds to the impression of heroic feats of labour and assembly (Clarke *et al.* 2024); this may seem an absurdly onerous undertaking and a crazily long journey, but that may have been the point, and whether transport was by land or water or both, it could scarcely have been harder to move one large stone from Scotland than the 80 bluestones from south-west Wales. The recent Stonehenge Riverside project has added the smaller ‘Bluestonehenge’ beside the River Avon, as well as further information about the character of the Avenue. It has also revealed important detail about the sequence of activity and development at the nearby Durrington Walls major henge, known from previous excavations (Wainwright 1989). It is now clear that the ditch and bank at Durrington, and before that a massive post circle, overlies a probably substantial Grooved Ware occupation including houses (Parker Pearson 2023a; 2023b). There are also a series of internal timber and other settings (Wainwright 1989; Parker Pearson 2023b; Ruggles and Chadburn 2024). Some of those are substantial in their own right (Parker Pearson 2023a), and Woodhenge too, though obviously dwarfed by its near-neighbour Durrington, is also a strikingly ambitious construction (Pollard 1995). Another research project, the Stonehenge Hidden Landscapes, has found an approximately 2 km-diameter ring of huge pits (perhaps 20 m in diameter and 5 m deep) encircling Durrington Walls (Gaffney *et al.* 2020), yet to be excavated, though coring has enabled a Late Neolithic radiocarbon date to be obtained from the lower fill in one pit.

Our sense of the scale of things has been further enhanced by isotopic analyses suggesting the movement of people and animals from considerable distances to the west and north (Evans *et al.* 2019; Madgwick *et al.* 2019), even if the most recent investigation appears to rule out derivation from Scotland (Evans *et al.* 2022). Probable feasting at Durrington Walls may also have been on the grand scale (Craig *et al.* 2015); there is variation among deposits in particular contexts (Parker Pearson 2023b, 162).

The chronology for the development of this complex has steadily improved over recent decades of research, though the precision of date estimates varies. A lot of activity appears to be packed into the interval between the Middle Neolithic and the probable appearance of Beakers from the 24th century cal BC onwards, with some of the further re-arrangements of stones in Stonehenge Phase 3 overlapping with the consolidation of the Beaker presence in the later centuries of the 3rd millennium (Parker Pearson 2023a; 2023b). On presently available evidence, dating is most precise for Durrington Walls, with a very short period for the pre-henge occupation around 2500 cal BC and a date in the early 25th century cal BC now indicated for the construction of the major henge; the encircling ditch at Woodhenge could be comparable, though it is not precisely dated, with further results in the pipeline (Parker Pearson 2023b, 71; Ruggles and Chadburn 2024). The start of Phase 2 at Stonehenge itself is not more precisely dated than to the modelled span of 2740–2505 cal BC and the end of Phase 2 is possibly as late as the 24th century cal BC (Parker Pearson 2023a, 51; 2023b, 150; Darvill *et al.* 2012). That is because of a dearth of available samples. It may still be worth noting an earlier alternative reading of the sequence which would place the great sarsen constructions in the 25th century cal BC (Bayliss *et al.* 2007), and thus taking this activity later in time. The orthodox view, however, is that the key sample associated with one of the trilithons is now to be interpreted as coming from a subsequent pit dug against a standing trilithon arrangement (Parker Pearson 2023b, 153).

Dorset: Knowlton and around Dorchester

Before looking, finally, at the complex of Late Neolithic monuments around Dorchester in southern Dorset, it is worth noting the concentration of constructions at Knowlton in Cranborne Chase, roughly halfway between Stonehenge and Dorchester (Gillings *et al.* 2008, 205 fig. 6.1). Here were potentially four henges, one of them substantial (The Southern Circle, 240 m in diameter) though not quite on the scale of Avebury, Marden, Durrington and Mount Pleasant, and another large

mound, though its date is far from certain (Gillings *et al.* 2008, 205; Gale 2018, 9). These belonged to a regional landscape with activity well documented in the Early and Middle Neolithic, notably including the Dorset cursus a short distance to the north and west (Green 2000). The immediate vicinity, however, is notably lacking in such evidence (Gale 2018, 10) and like Marden in the Vale of Pewsey and perhaps Stanton Drew, Somerset, this could be another case of Late Neolithic intake. There is so far only one radiocarbon date from the Southern Circle (*ibid.*, 6).

The concentration of constructions around Dorchester is much better documented. These belong to another long-used landscape, shown by both survey and excavation as going back into the Early and Middle Neolithic, though with more activity visible in these earlier periods on the chalk downland and ridgeways than in the lower-lying parts nearer the River Frome where Late Neolithic monuments cluster.

The bank barrow overlying the causewayed enclosure at Maiden Castle dates to the Middle Neolithic (Whittle *et al.* 2011), and there are other cursus and related monuments in the area (Greaney *et al.* 2025), while the lower-lying Flagstones enclosure, of a transitional form, probably dates to the late 4th millennium (*ibid.*). A change of pace and scale is seen in the construction of three major monuments in the mid-3rd millennium, close to one another on a low ridge near the River Frome. The major henge at Mount Pleasant, well over 300 m in diameter, contains the also impressive Site IV, comparable in size to Woodhenge, and an internal palisade, and is overlooked by another large barrow, the Conquer Barrow, some 7 m high

(Greaney *et al.* 2020; Wainwright 1989). The henge of Maumbury Rings is smaller, but with a diameter of some 100 m, nonetheless substantial; it is further distinguished by the presence of a circuit of deep shafts within the bank (Marshall *et al.* 2024b, and references). Greyhound Yard is a very big, more or less oval, single-circuit palisade enclosure, some 380 m in diameter; its substantial posts set in individual pits were more widely spaced than at West Kennet in north Wiltshire (Marshall *et al.* 2024a, and references). The scale of things is also again indicated by the transport into Mount Pleasant of animals from off the chalk, as already noted for the West Kennet palisade enclosures, Marden and Durrington Walls (Madgwick *et al.* 2019).

Recent radiocarbon dating and chronological modelling have provided exemplary greater precision for the timing of these considerable constructions. Things came fast at Mount Pleasant, over perhaps four or five generations, first the henge ditch in the early to mid-26th century cal BC, then the Conquer Barrow around 2500 cal BC, to be followed by the palisade, probably in the late 26th or early 25th century cal BC, and by the ditch surrounding Site IV (perhaps later than the timber setting itself) probably in the first half of the 25th century cal BC (Greaney *et al.* 2020, 219 fig. 12). The Maumbury Rings henge was probably completed in the middle decades of the 25th century cal BC (Marshall *et al.* 2024b), perhaps soon after the events modelled at Mount Pleasant. The Greyhound Yard palisade enclosure was also probably constructed in the middle decades of the 25th century cal BC (Marshall *et al.* 2024a), its date estimates being very similar to those for Maumbury Rings.

DISCUSSION

Imperfect though the evidence discussed above may be, it strongly suggests a burst of activity in the later part of the Late Neolithic. Most of this is concentrated in the later 26th and 25th centuries cal BC, extending also into the 24th. The first signs of things happening on an unusually large scale in southern Britain may be the initiation of flint mining at Grime's Graves in Norfolk (Healy *et al.* 2018); there are no major other monuments in East Anglia, though the region was certainly in touch with central-southern England (Cleal and Pollard 2023), and the possible large henge at Waulud's Bank, Bedfordshire (Wainwright 1989; Leary and Field 2012), is to be noted. There is no space here to discuss developments in a series of other areas in southern Britain; though it seems clear that large-scale activity was not confined to central-southern England, it was preeminent there. This involved the building of earthworks comfortably over 300 m in diameter with

correspondingly big ditches and banks, palisade enclosures requiring hundreds of substantial timbers, and the exceptional constructions of Stonehenge and Silbury Hill, which must have involved millions of hours of labour.

As far as I am aware, this emergent sequence of frenzied activity has not so far been modelled overall, not least because a number of key contexts remain to be dated and modelled, and my informal observations of its possible trajectory should be treated with suitable caution. As things stand, perhaps there is a case for the major henges coming first, and of these Mount Pleasant perhaps having priority, to be followed locally by Maumbury Rings but on the wider stage also by Avebury and then, following its pre-henge activity, by Durrington Walls; more dates for Marden are awaited. If this is the sort of sequence which happened, might it suggest a process of innovation followed by rapid

regional emulation (whatever the social formations involved)? Such a putative process took place both in long-established locales, as at Avebury, Durrington and Mount Pleasant, and also in previously less important areas as seen in the cases of Marden and Knowlton. The palisade enclosure at Greyhound Yard followed in the mid-25th century, perhaps slightly after the palisade within Mount Pleasant; the position of the palisade enclosures at West Kennet is yet to be definitively sorted. Silbury Hill was initiated in the late 25th century, its main building continuing through the 24th into the 23rd century cal BC. Where might the imprecisely dated second phase of Stonehenge fit in? The temptation recently has been to link it with the activity at adjacent Durrington Walls, and given that, with the earliest activity there. I wonder if it could not rather go with the construction of the henge ditch at Durrington or even later. The alternative reading of the Stonehenge dating noted above would draw it closer to Silbury, and a long time ago I argued (Whittle 1997) that Silbury and Stonehenge could be seen as rival — and by implication contemporary or at least overlapping — conceptions of the creation of the universe. Whatever the best order of events, this is certainly a much more dynamic situation than modelled in previous generations of research as rather static chiefdoms or ‘ritual authority structures’ (Renfrew 1973; Thorpe and Richards 1984).

Given a rapidly changing trajectory, may it not be the case that we should now be looking for multiple causes and circumstances? The first objective then will be better to understand the emergence of major henges. That will presumably involve further enhanced appreciation of the overall sequence of henge development, which we can see going back to the turn of the 4th millennium, variously in the evidence from Orkney and at sites like Flagstones. The general picture of settlement in the Late Neolithic is very varied, but recent regional reviews across southern Britain emphasise how patchy this could be (Copper *et al.* 2023). There is also the notion, derived from summed probability distributions of radiocarbon dates, that there was a relative decline in population in the 3rd millennium (Shennan 2018). Conventional wisdom (*e.g.* Parker Pearson 2023a, 50; Vander Linden 2024, 43) has it that Britain was isolated from the European continent at this stage, though I think on the varied basis of possible influences on the emergence of Grooved Ware (Copper and Whittle 2023, 7–8), the introduction of the Orkney vole (Bayliss *et al.* 2017a, and references) and now the evidence for plague in the northern isles at the Banks chambered tomb (Allentoft *et al.* 2024; *cf.* Swali *et al.* 2023), that this possible separation is much exaggerated (note also the querying in Sheridan 2023, 291–292). Nonetheless, the emergence of major

hengings might best be sought in sets of local and regional circumstances, either as part of a trend to local political domination in cycles of change or, contrary to that often-favoured idea, as some sort of counter or levelling process in socially fluid and contested times (*cf.* Carlin and Cooney 2020, 326; Hofmann *et al.* 2019; 2024).

If that goes some way to thinking about the 26th century cal BC, what about the 25th and 24th centuries? Given the appearance of Corded Ware from the early part of the 3rd millennium, then of Beaker users in varying parts of adjacent continental Europe in the mid-3rd millennium (Armit and Reich 2021; Vander Linden 2024), and finally the arrival of Beaker people and practices in England probably in the earlier 24th century cal BC (Jay *et al.* 2019), it is very plausible, for a connected world, to argue for anticipation of and reaction to impending change. The case has already been made for a direct connection between the circumstances in which Silbury Hill was set up and the appearance in England of Beaker people and practices (Leary and Marshall 2012) — a view which I strongly endorse, since the coincidence in timing is so striking. I wonder now if Stonehenge phase 2 cannot also be brought into the same picture. It has been suggested, following an idea of Gordon Childe (1957, 331), that the great lithicisation of the Stonehenge monument could represent some kind of political unification of southern Britain, and perhaps beyond (Parker Pearson 2023a, 66, 159; 2023b, 165), but so far that attractive idea has lacked any specific sense of historical context. Might not the bringing of great stones from north Wiltshire and a large stone from north-east Scotland go alongside the literally monumental goal of setting up Silbury Hill, as an attempt at the definitive demonstration of old values and beliefs, an attempted validation of former ways of doing things in the face of a rapidly changing wider world?

I began by mentioning Trypillia mega-sites. I think there is a distressing tendency in some of the literature to assume that there are somehow universal traits in what constituted unusually large sites (Gaydarska and Chapman 2022). I am increasingly uneasy with the all-too-common search for generalisation, such as expressed in the different context of migration studies as looking for ‘cross-disciplinary supra-regional comparison of frontier dynamics’ (Parker 2006, 77). I have tried to argue here for the importance of specific events, circumstances and history. My case study may nonetheless have some common ground with Trypillia and other studies. Were Trypillia mega-sites, with which Johannes has done so much, also to do with anticipating and countering threats from the outside world? Was thinking big, paradoxically, a frequent way to counter stress and troubled times?

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CHAPTER 8

Counting People



Figure chapter 8: Maidanetske, Ukraine. Reconstruction of a bird's-eye view of the Trypillia mega-site in phase 3 between 3800 and 3700 BCE (Drawing: Susanne Beyer; graphic: Petra Horstmann).

Armut und Reichtum in einer Residenzstadt München im Aufbruchjahr 1397

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KEYWORDS: German history, late medieval history, urban history, financial history, social inequality

Zusammenfassung

Soziale Ungleichheit wird exemplarisch an der Steuerrechnung Münchens im Revolutionsjahr 1397 vorgestellt. Soziale und damit auch politische Ungleichheiten waren ein unbewältigtes Problemfeld spätmittelalterlicher Städte Zentraleuropas. Das Münchner Steuerbuch bietet selbstverständlich nur eine Momentaufnahme. Aber es eignet sich in besonderer Weise für die Fragestellung nach den weiten Dimensionen von arm und reich, nach Genderaspekten, nach zeitgenössischen Größenverhältnissen der betroffenen sozialen Gruppen,

die unterhalb der Armuts- und Bedürftigkeitsgrenzen, ja des Existenzminimums lebten, sowie nach der sozial-topographischen Verteilung von Armut und Reichtum im Stadtraum. Denn neben der als direkte Steuerart üblichen Vermögensteuer wurden auch die Einkommen aller Stadtbewohner ab einer festgelegten Mindestgrenze besteuert. Damit erst wird außer dem Klerus und den Bediensteten der Großteil wirtschaftender Männer und Frauen in den Städten sozialgeschichtlich sichtbar.

Abstract

Social inequality is exemplified by the tax bill of Munich in the revolutionary year 1397. Social and thus also political inequalities were an unresolved problem area of late medieval cities in Central Europe. Naturally, the Munich tax book only provides a snapshot. However, it is particularly suitable for an examination of the broad dimensions of rich and poor, gender aspects, the contemporary proportions of the affected social groups who lived below the poverty and indigence thresholds, even

the subsistence level, as well as the socio-topographical distribution of poverty and wealth in the urban space. In addition to the wealth tax, which is a common direct tax, the incomes of all city dwellers were also taxed above a fixed minimum threshold. As a result, the majority of economically active men and women in the cities, apart from the clergy and servants, become visible in social history.

ARM UND REICH

„Wir Bürger reich und arm“ — in solchen Urkundenformeln spätmittelalterlicher Städte wurde die bürgerliche Genossenschaft und der Gemeine Nutzen beschworen (Schubert 1992, 109), die Vorstellung einer idealen Gemeinde mithin, in der der individuelle Vorteil jeder Bürgerin und jedes Einwohners nivelliert, begrenzt und an eine von der Allgemeinheit getragene

Resilienzkonzeption von Urbanitas, in der Sicherheit an erster Stelle stand, gebunden wurde. Doch die ökonomischen Unterschiede in den Stadtgemeinden und die Partizipationsmöglichkeiten an der Macht waren beträchtlich und entsprechend auch das latente, häufig sich in Protest und Aufstand artikulierende Misstrauen der schwächeren Glieder städtischer Gesellschaft.

Denn die Regierenden veruntreuten zugunsten ihres Eigennutzes das Gemeingut: *social inequality* und ihre multiplen Folgen — ein überzeitliches Thema (Hansen und Müller 2017).¹

In zentraleuropäischen Städten am Ende des 14. Jahrhunderts lebten ungefähr 50 bis 60 Prozent der Einwohnerschaft unterhalb der Armutsgrenze (Dirlmeier 1978, bes. 529–531). Arm sein bedeutete nach einer einfachen, das prekär Unstete derartiger sozialer Praktiken aufgreifenden Formel, dass die Betroffenen nicht dazu in der Lage waren, „eine über den Tagesbedarf hinausgehende Ausgabe bar zu bezahlen“ (ebd., 526). Arme Frauen und Männer hofften Tag für Tag Arbeit zu finden, sie bangten in den saisonalen Konjunkturen der Ökonomie und in den von Wetter und Klima, von Bakterien und Viren abhängigen Wechsellagen der Zeit um ihre materielle Existenz. Mit der machtförmig ausgetragenen Kultur und dem Luxuskonsum der Reichen und Mächtigen in Brügge oder Lübeck, Lyon oder Nürnberg hatten sie nichts zu tun (Fouquet 1999; Germek 1988). Sie waren allenfalls im Heer der Bediensteten in den Stadthäusern und auf den Landgütern solcher Herren und Damen beschäftigt (Fouquet 1998, 347–504).²

Die in den zumindest größeren Städten in differenter Dichte überlieferten Steuerbücher gelten „als die einzig statistisch auswertbaren Unterlagen zum Problem wirtschaftlicher und sozialer Verhältnisse“ (Dirlmeier 1978, 491).³ Dabei wurden von den zeitgenössischen Funktionsträgern allenfalls nur in Ausnahmefällen auch die Armen über die direkte Besteuerung erfasst. In München, um 1400 eine größere Mittelstadt mit etwas mehr als 10.000 Köpfen und eine der Residenzstädte der Herzöge von Bayern (Solleder 1938, 536f.), haben die vom Stadtrat bestellten Steuerer in den 31 für die Zeit um 1400 (1368–1410) erhaltenen Steuerbüchern in der Regel ebenfalls nur die wohlhabende Bevölkerung mit der Besteuerung ihres Immobilien- und Rentenbesitzes berücksichtigt.⁴ Im Jahre 1397 indes wurde auch die besitzlose

Stadtbevölkerung steuerlich veranlagt und im überlieferten Steuerbuch verzeichnet. Ausgenommen von der Steuerpflicht, die 1397 mithin Vermögen- und Einkommensteuer umfasste, waren wie allgemein üblich die Angehörigen des Stadtklerus und der in der Stadt sitzenden Orden, die Insassen der Spitäler und Siechenhäuser, die Masse des Gesindes und die jüdische Gemeinde, die einer eigenen Besteuerung unterlag, sowie — selbstverständlich in einer Residenzstadt — die adligen Mitglieder und die Bediensteten des herzoglichen Hofes (ebd., 199f.).⁵

Die Münchner Überlieferung des Jahres 1397⁶ eignet sich daher besonders gut für die hier interessierende Frage nach den Ausprägungen sozialer Ungleichheiten in mittelalterlichen Residenzstädten. Methodische Vorsicht ist dabei allerdings mit dem Blick auf die nicht rekonstruierbaren Unterschiede zwischen Steuer- und Realvermögen und den unbekannt bleibenden individuellen Aushandlungsspielräumen bei der Veranlagung geboten (Dirlmeier 1978, 492–503 mit der älteren Literatur), gerade wenn wie in München Vermögen und Einkommen für die Bemessung eine Rolle spielten (Solleder 1938, 197–198). Zudem ließen die Steuerer neben den Namen der Steuerpflichtigen häufig auch die Berufe verzeichnen und die Steuerpflichtigen Straße für Straße bzw. Viertel für Viertel aufzuführen. Diese besonderen Umstände schriftlicher Verwaltungstätigkeit ermöglichen methodisch sowohl personengeschichtliche Beobachtungen über das Zusammenleben von arm und reich in engsten Wohnumfeld als auch einige statistische Einblicke in die sozialtopographische Verteilung von arm und reich im urbanen Raum (ein gutes Vorbild bietet: Füglistner 1981). Es ist der Versuch, exemplarisch eine tiefere, detailreichere Analysesonde an ein für die Sozialgeschichte der Stadt München wertvolles Quellenmaterial einzusetzen, das bislang zwar eine verdienstvolle allgemeine Übersicht gefunden hat (Solleder 1938, 189–221), aber keinen Blick in die Tiefe der sozialgeschichtlichen Details.

1 Von Seiten der Wirtschafts- und Sozialgeschichte des Mittelalters jüngst aus der Fülle der Literatur: Schläppli 2021, 53–67, bes. 59.

2 Ertl 2020 mit einer Untersuchung des Verzeichnisses der Haushaltsvorstände des Wiener Widmerviertels.

3 Überblick über Steuerbücher einiger süd- und norddeutscher Städte: Wozniak 2018, 81–106, hier 84, 87.

4 StadtA München, Steuerbücher.

5 Mägde und Knechte, die in seltenen Ausnahmefällen Hausbesitz und von daher auch das Bürgerrecht besaßen,

unterlagen selbstverständlich der Stadtsteuer wie auch anderen Steuern. 1445 ergab eine amtl. Erhebung die Zahl von 1454 Bediensteten in München (Solleder 1938, 531).

6 Das Steuerbuch 1397 (StadtA München, Steuerbuch 1397) ist folgendermaßen geordnet: f. 1r: Eingangsprotokoll; f. 1v–41r: Namen der Steuerpflichtigen, Häuser etc. mit den Steuerbeträgen, ggf. Vermögensangaben auf je einer Zeile; f. 41v: Schlusssumationen; f. 41ar–44r: Ausgaben der Steuerer, in der Regel Gelder an Rentenempfänger, aber auch Lohnzahlungen.

ORGANISATION DER MÜNCHNER BÜRGERSTEUER

Die sich im Laufe des 13. Jahrhunderts von den landesherrlichen Steuerrechten emanzipierende Selbstbesteuerung der Residenzstadt München beruhte auf der jährlich von den drei Steuerern aus dem Stadtrat erhobenen Bürgersteuer. Sie war als Vermögensteuer ausgekleidet und basierte auf den Grundsätzen der eidlichen Selbsteinschätzung und der Proportionalbesteuerung. Die Wohlhabenden, gleich ob Bürger oder Einwohner, wurden je nach ihren individuellen Immobilienvermögen und Renteneinkommen besteuert (Kreitner 1950, 9–25; Solleder 1938, 196–199, 205–209). Im Jahre 1383 deklarierte man auf diese Weise 1104 steuerpflichtige Haushaltsvorstände, ca. zwei Drittel davon besaßen das Bürgerrecht (Rädlinger 1992, 108).⁷ Der übliche Steuersatz betrug zwischen 1387 und 1419 und so auch 1397 traditionellerweise sechs Münchner Pfennige (d) vom Pfund Pfennig (240 d), mithin 2,5 % (Solleder 1938, 209).⁸

Individuelle Steuerleistung hat überzeitlich mit Aushandlungen zu tun, in der Moderne mit Absetzungs- und Abschreibungsmöglichkeiten oder anderen legitimen Instrumentarien der Steuervermeidung, in spätmittelalterlichen Zeiten mit Verhandlungen der betroffenen Haushaltsvorstände mit den Steuerern über die tatsächlichen Zahlungen, die sich aus der eidlichen Selbsteinschätzung ihrer Vermögenswerte und/oder Einkommen ergaben. So finden sich im Steuerbuch 1397 fortlaufend widersprüchliche Notierungen, wie sie in beliebig zu vermehrender Weise zum Beispiel im Vorstadtviertel „Beim Spital“ dokumentiert sind. Da zahlte Hansel Messerer 60 Pfennige für zwei Pfund Pfennig Vermögen, während sein unmittelbarer Nachbar Gobel Koch ebenfalls 60 Pfennige aber für vier Pfund zu leisten hatte. Der nebenan wohnende Ruppel Brunner musste lediglich 40 Pfennige für drei Pfund begleichen und die etwas entfernter hausenden Frauen, Els Mawrman und Els Swab, hatten 18 bzw. 32 Pfennige „fur nihil“, also nicht aus Vermögen, sondern aufgrund

ihrer Einkommen an Steuern zu geben (StadtA München, Steuerbuch 1397, f. 1v.).

Am Ende des 14. Jahrhunderts nahm der Steuerdruck auf die gesamte Stadtbevölkerung durch externe und interne Faktoren stark zu. Die Oberbayerische Landschaft gestand den defizitären fürstlichen Kassen 1390 und 1395 die Sondersteuer des 20. Pfennigs zu, im Pestjahr 1396 beschwerte eine außerordentliche herzogliche Verbrauchsteuer auf Wein und Met die Krise noch zusätzlich (Solleder 1938, 503f.). Überdies sah sich der Münchner Stadtrat aufgrund seiner defizitären Kassenlage genötigt, 1383 und 1390 den zweifachen Steuersatz bei der Bürgersteuer zu fordern (ebd., 211 Tabelle: Steuerbelastung und Steuerertrag 1367–1500). Schließlich wurde 1396 zum ersten Mal die Vermögensteuer um eine allgemeine Einkommensteuer für die Besitzlosen ergänzt und, wie genannt, 1397 in dieser Weise fortgeführt. Das verschärfte die traditionell schon regressive Steuerprogression. Denn der eingeführte sogenannte „Habnit“, eine Mindeststeuergrenze, wirkte als „feste Haushaltungssteuer“ für die Menge der besitzlosen Tagelöhner, der ledigen Lohnarbeiterinnen und kleinen Handwerker (ebd., 210). Durch diese regressive Verbreiterung des Steuerminimums auf alle Bürger und Einwohner, eine der unsozialsten Maßnahmen bei der Steuerung der Distribution gesellschaftlicher Lasten (Zur Bewertung auch: ebd., 503f.), verdoppelte sich 1397 die Zahl der Steuerpflichtigen gegenüber 1383 auf 2273 (StadtA München, Steuerbuch 1397, f. 1v–41r.).⁹ Der durch all diese Maßnahmen ausgelöste soziale Druck auf die ärmere Bevölkerungsmehrheit Münchens muss so unerträglich gestiegen sein, dass er zum Katalysator zunächst der Frontstellung der sich emanzipierenden Gemeinde gegen den Rat und schließlich im Juli 1397 und in den nachfolgenden Monaten bis August 1398 zur Revolution und Beseitigung der überkommenen Rats Herrschaft führte (Fouquet in press.).

STATISTIK 1 – WAS BEDEUTET ARM UND REICH IN MÜNCHEN UM 1400?

Ulf Dirlmeier hat vor etwas mehr als vier Jahrzehnten die maximalen tatsächlichen Jahreseinkommen für Gesellen und Meister auf den Baustellen oberdeutscher

Städte im Spätmittelalter „von über 20 bis über 40 fl“ (rheinische Gulden) nachgewiesen, wobei die Höhe des Verdienstes, ab der die Möglichkeit bestand, über

7 Zur ungefähr gleichen Anzahl im Jahre 1403 (Gleba 1989, 188f.)

8 Daneben wurden in diesem Zeitraum auch 8 d (Pfennig) vom Pfund Pfennig (3,3 %) erhoben. Zum Steuerfuß 1397: StadtA München, Steuerbuch 1397, f. 1r.

9 Berücksichtigt wurden nur die personell Steuerpflichtigen, nicht die zur Steuer herangezogenen Häuser, wohl Miethäuser, deren Ertrag man der Einkommensteuer, gesondert vom Haushalt des Eigentümers, unterwarf, und auch nicht die Stadthöfe umliegender Klöster, die zum geringeren Teil auch der Steuerpflicht unterworfen wurden.

Sparsen Vermögen zu bilden, „nicht exakt“ zu bestimmen sei. Die Belege zeigen aber klar, dass mit etwas mehr als 40 rheinischen Gulden pro Jahr „die Obergrenze des nur zur Existenzsicherung ausreichenden Arbeitseinkommens anzunehmen“ sei. Schon die Armenpfünde in einem Spital kostete 50 rheinische Gulden. „Die untere Grenze des Existenzminimums“ setzte Ulf Dirlmeier aufgrund seiner Auswertungen von Almosensätzen bei ca. acht rheinischen Gulden an (Dirlmeier und Fuhrmann 2005, 426; Dirlmeier 1978, 518 f.). Dieses bis heute gültige Ergebnis, vornehmlich gewonnen im Bau, einem der Leitgewerbe der Zeit, kann durch die Dotationen zweier Klerikerpfünden im Münchner

Heilig-Geist-Spital um die lokalen zeitgenössischen Dimensionen erweitert werden. Dort stifteten 1396 und 1397 zum einen die Herzöge Stephan III. und Johann II. von Bayern eine Kaplaneipfunde, zum anderen Hans Rudolf, der einem der beiden reichsten Haushalte Münchens vorstand, die Präbende des Spitalspfarrers mit Bezügen von jeweils 32 rheinischen Gulden jährlich, die Pfarrersstelle aber erweitert um Naturalgülden und freie Logis.¹⁰ Diese Hinweise auf die Bedürftigkeitsgrenze zwischen 35 und 40 rheinischen Gulden im München der Zeit um 1400 gibt dem statistischen Blick auf das vorliegende Steuerbuch die Dimensionen der Besitzlosigkeit und der Armut im städtischen Raum vor.

Tabelle 1. Steuerpflichtige nach Steuerklassen (München 1397).¹¹

d	0	40	150	180	270	330	960	1440	1520	2400	4800	>4801
fl		12	44	53	80	98	284	427	569	711	1422	>1422
Z	105	420	1359	51	80	37	125	31	21	11	19	14//2273
%	4,6	18,5	59,9	2,2	3,5	1,6	5,5	1,4	0,9	0,5	0,8	0,6//100

d Steuerklassen in Pfennigen; fl Vermögenklassen in rheinischen Gulden; Z Anzahl der Steuerpflichtigen in den Steuerklassen; % Anteile der Steuerpflichtigen nach Steuerklassen.

Setzt man nach der eingehenden Untersuchung des Steuerbuchs von 1397 bei aller Vorsicht gegenüber selbsterklärten und mit den Steuerern ausgehandelten Jahreseinkommen bei 44 rheinischen Gulden eine statistische Grenze, dann lebten also 1883 von den 2273 der personell zur Steuer veranlagten Münchnerinnen und Münchnern des Jahres 1397 82,9% unterhalb jener Obergrenze, die allgemein die Existenzsicherung markierte (Tabelle 1).¹² Dieses Ergebnis ist an sich schon als außerordentlich hoch einzuschätzen, es ist nur mit den für die Reichsstadt Augsburg allerdings für rund neun Jahrzehnte später ermittelten Armutszahlen von 83,3% (1475) vergleichbar (Rogge 1996, 215 f.). Dagegen lag 1384 in der etwas kleineren Reichsstadt Esslingen (2095 Besteuerte mit städtischem Territorium) zum Beispiel der Anteil der Steuerzahler unter 40 rheinischen Gulden „nur“ bei 55% (Wozniak 2018, 102). Die Münchner Zahlen verweisen daher auf äußerst schwierige bis hin zu sehr prekären sozialen Verhältnissen in einer

glanzvoll unter Kaiser Ludwig dem Bayern zur Residenz ausgebauten Handwerksstadt (Störmer 1987, 1–24). Sie werden noch gesteigert durch zwei statistische Ergebnisse, die in Tabelle 1 teilweise wiedergegeben sind: 420 Menschen bzw. Haushalte oder 18,5% der steuerpflichtigen Bevölkerung gaben ihre Arbeitseinkommen in einem Intervall zwischen etwas mehr als zwei und zwölf rheinischen Gulden an. Das bedeutet: Ein großer Teil dieser Steuerpflichtigen lebte jenseits der untersten Grenze des Existenzminimums von ca. acht rheinischen Gulden, und zwar in einem Grenzbereich zwischen der sozialen Großgruppe der „working“ oder „labouring poor“ und denjenigen, die man situativ oder auf Dauer zu den primär Armen rechnet. Überdies waren 105 Personen oder Haushalte (4,6%) gänzlich mittellos, gehörten damit absolut zur primären Armut.¹³ In Esslingen konnten 1384 sogar 333 Personen (15,8% der zur Steuer Veranlagten) aufgrund ihrer Mittellosigkeit nicht zur Steuer herangezogen werden (Wozniak 2018,

10 Vogel 1960, Nr. 192, 280–282; Nr. 196a, 287–291. Zum Wert von Altrapfunden: Dirlmeier 1978, 75–82. Zu Hans Rudolfs Vermögen: StadtA München, Steuerbuch 1397, f. 34v.

11 Der Kurswert des rheinischen Goldguldens schwankt im Bitmetallismus Gold-Silber der Zeit um 1400 in München zw. 135 und 138 Münchner Pfennige (d). Das Pfund bildeten 240 Münchner Silberpfennige, gebündelt in acht

„lange“ Schillinge zu je 30 Pfennigen (Dirlmeier 1978, 579).

12 Fridolin Solleder setzte diese Grenze 1397 mit einem Steuerbetrag von 30 Pfennig, was einem Einkommen von rund 18 rheinischen Gulden entspricht, viel zu niedrig an (Solleder 1938, 215).

13 Zu solchen und ähnlichen Verhältnissen in anderen Städten (Rabeler 2015).

102). Diese soziale Großgruppe — Arbeitslose, Kranke und Alte, die nicht mehr erwerbsfähig waren — normiert als „verschämte Hausarme“ und rigide von den Bettlern separiert, konnte allein mit den zeitgenössisch unzureichenden Instrumentarien (Almosen, Stiftungen

von Siechen- und Bruderhäusern, auch gelegentlichen öffentlichen Arbeitsbeschaffungsmaßnahmen, Monti di Pietà etc.) nicht wirksam unterstützt werden. Sie bildete ein Dauerproblem jeder zentraleuropäischen Stadtregierung.¹⁴

Tabelle 2. Verteilung des Steueraufkommens auf die Steuerklassen (München 1397).

d	40	60	90	150	180	270	330	960	1440	1920	2400	4800	>4801
fl	12	18	27	44	53	80	98	284	427	569	711	1422	>1422
d	12148	58606	12910	20124	8717	17770	11311	68672	36945	37277	23538	61374	124083
%	2,5	11,9	2,6	4,1	1,8	3,6	2,3	13,9	7,5	7,6	4,8	12,4	25,0

d (1. Zeile) Steuerklassen in Pfennigen; fl Vermögenklassen in rheinischen Gulden; d (3. Zeile) Steuerleistung in den Steuerklassen insgesamt in Pfennigen; % Anteile der Steuerklassen an der Steuerleistung.

Bei der Verteilung des Steueraufkommens unter der steuerpflichtigen Bevölkerung spiegelt sich der Befund großer, ja beträchtlicher sozialer Ungleichheiten in der Residenzstadt München um 1400 noch deutlicher wider (Tabelle 2). Rund 83 % der Steuerpflichtigen (40–150 Pfennige) erbrachten gerade einmal 21,1 % vom Gesamtertrag. Die 14 größten Münchner Haushalte dagegen trugen allein mit 25 % zum Steueraufkommen der Stadt bei. Der reichste Haushalt allein leistete mit 16.347 Pfennigen, was einem Steuervermögen von 4843,5 rheinischen Gulden entspricht, 3,3 % vom Gesamtertrag. Das war nur etwas weniger als der gesamte Steuerertrag von 80 Münchnerinnen und Münchnern, die ihrer Vermögenslage von 53–80 rheinischen Gulden gemäß zwischen 181 und 270 Pfennigen (3,6 %) an Steuern zu geben hatten.

Auffallend ist ebenfalls, dass die mit 59,9 % weit überwiegende Zahl der Münchner Steuerpflichtigen kleinste und kleine Vermögen besaß, die zu Steuer-

zahlungen zwischen 41 und 150 Pfennigen führten. Von einer homogenen unteren Mittelschicht zu sprechen, wie die ältere Forschung dies gerne tat,¹⁵ verdeckt die sozialen Unterschiede der Zeit. Denn die sozialen Milieus klafften in jenem Segment mit Steuervermögen von 12, 18, 27 und 44 rheinischen Gulden beträchtlich auseinander. Mitglieder unterschiedlichster Sozialgruppen sind darin zu finden: Tagelöhner, Tagelöhnerinnen und arme Witwen, die mühsam ihren Alltag gestalteten und zur Miete wohnten – sie sind vornehmlich im Segment unter 40 Pfennigen zu finden. Daneben erscheint die große, in sich wieder gestaffelte Schar der überwiegend eigene kleine Häuser besitzenden und andere Lebensformen aufweisenden wenigen (Altwaren-)händlerinnen und Gewürzgreplerinnen sowie der vielen kleinen Handwerker, die ihre Werkstätten im Alleinbetrieb ohne Lehrlinge und Gesellen führten (insg. 18,6 %; Schwerpunkt bis 40–60 Pfennige mit 11,9 %).

STATISTIK 2 – WER WAREN ARME UND REICHE UND WO WOHNTE SIE IN MÜNCHEN?

Arm sein, das wird deutlich, bedeutete im beschränkten Raum selbst mittelalterlicher Großstädte nicht, sozial segregiert zu sein. Die räumliche Trennung von arm und reich wurde erst in den Idealstadtentwürfen um 1500 zum Thema (Dirlmeier und Fuhrmann 2005, 427 f.). Aber es wird schon deutlich, dass in den Vierteln der Kernstadt Münchens um die Pfarrkirchen St. Peter und die Frauenkirche, wo sich der Reichtum und die sehr bedeutenden Vermögen über 1422 rheinischen

Gulden versammelten und daher mit weitem Abstand die reichsten Quartiere waren (Tabelle 3 und 4), signifikant weniger Bedürftige wohnten als in ärmeren Vierteln außerhalb oder am Rand der Kernstadt wie z. B. am Rossmarkt (südlicher Teil des Oberangers) und in der Schaefflergasse (nordöstlich der Frauenkirche). Sie weisen mit 33 bzw. 33,9 % Steuerpflichtige auf, die am oder unterhalb des Existenzminimums lebten, sowie acht bzw. 8,1 % primär Arme (Tabelle 3).

14 Aus der Unüberschaubarkeit der Literatur jüngst Skambraks 2023.

15 Freilich immer noch ein fulminanter Beitrag und

markanter Meilenstein der deutschen Sozialgeschichte nach dem Vorbild der französischen „Annales“ (Maschke 1959).

Tabelle 3. Armut und Besitzlosigkeit in den Gassen und Vierteln Münchens im Jahre 1397 (Stahleder 2006; Stimmelmayer 1980; Burgmaier/Schneider 1958–1977).

	Bis 44 fl / %	Bis 12 fl / %	Armut / %	Ø Vermögen / fl	Stadtviertel
Vor dem Spital / Schiner Tor	85,2	14,8	7,4	22,4	Angerviertel
Krötental (Rosental)	83,9	7,7	0	31,2	Angerviertel
Angergasse	73,4	18,4	6,1	41,2	Angerviertel
Mühlgasse	66,6	25,3	4,0	21,8	Angerviertel
Rossmarkt	97,0	33,0	8,0	14,7	Angerviertel
Sendlinger Gasse	83,2	16,8	2,6	31,1	Angerviertel
Althaim	98,2	25,5	5,5	21,0	Hackenviertel
Schmalzgasse	97,9	18,7	0	16,7	Hackenviertel
Brunnengasse	100,0	21,6	2,7	13,7	Hackenviertel
Kornbäcker Gasse	90,3	29,3	4,9	20,9	Hackenviertel
Neuhauser Gasse	83,4	23,4	1,5	39,8	Hackenviertel
Engengasse	89,5	21,1	4,2	35,5	Kreuzviertel
Schaefflergasse	96,9	33,9	8,1	18,8	Kreuzviertel
Kreuzgasse	77,0	11,5	5,1	45,1	Kreuzviertel
Prandalgasse	92,7	24,1	0	55,5	Kreuzviertel
Fingergasse	94,7	10,5	5,3	24,7	Kreuzviertel
Schwabinger Gasse primär	87,8	27,5	5,5	35,1	Graggenauer Viertel
Schwabinger Gasse sekundär	81,3	16,8	6,5	37,6	Graggenauer Viertel
Grakenau (Platzl)	91,8	15,3	4,1	23,1	Graggenauer Viertel
Ircher Gasse	75,7	12,1	0	39,8	Graggenauer Viertel
Tal prima Marie	85,8	13,6	6,4	65,1	Graggenauer Viertel
Tal St. Peter	82,7	23,6	2,5	36,2	Angerviertel
Fischergasse	91,6	13,8	2,8	20,8	Angerviertel
Kernstadt St. Petri	57,0	9,1	3,2	282,8	Ältester Stadtkern
Kernstadt St. Marie	64,5	8,7	9,5	142,3	Ältester Stadtkern
	100,0	100,0	100,0		
Zahlen insgesamt	1786	420	104		

fl rheinische Gulden; Ø durchschnittliche Vermögen.

Es ist nur auffallend, aber nicht untypisch, dass sich im Quartier um die Frauenkirche ein sehr hoher Anteil von 9,5 % primär Armen unter die Reichen und Superreichen mengte. So wohnten etwa die völlig mittellosen alten Leute Michel Messerer und Gred Chaufflin — beide hatten wohl von ihren früheren Berufen her ihre Namen empfangen — als Untermieter bei den vermögenden Ratsherren Konrad und Franz von Hausen (je 560 fl Steuervermögen) sowie in unmittelbarer Nachbarschaft des Stadthauses, das dem reichen Ratsherrn Jörg Kazmair und seiner Schwester (1778 fl Steuervermögen) gehörte (StadtA München, Steuerbuch 1397, f. 37v.).¹⁶ Der arme Erhart Kemnater wohnte neben dem vermögenden Hans Rulein (889 fl Steuervermögen) und

Johannes Halbschuster hatte wohl Unterschlupf in einem Zinshäuslein des wohlhabenden Hans Zoler (320 fl Steuervermögen) gefunden (StadtA München, Steuerbuch 1397, f. 39v u. 40v.).¹⁷ Im Peters-Viertel hausten zwei arme Frauen, die Gresemeiderin, die ihr Leben, wie ihr Name sagt, mit Grasmähen und dem Einholen von Viehfutter fristete, und die Witwe Sunnstererin als Untermieterinnen bei den sehr reichen Brüdern Hans und Peter Pötschner aus einem alten Ratsherren-geschlecht (2133 fl Steuervermögen; StadtA München, Steuerbuch 1397, f. 34v.).¹⁸

Blickt man auf die von Handwerk und Handel geprägten Stadträume außerhalb der Kernstadt, so fällt zunächst das Tal Mariä, das Graggenauer Viertel, auf,

¹⁶ Zu Kazmair: Fouquet in press.

¹⁷ Zu Konrad und Franz von Hausen: Oefele 1878, 442f., 470, 492.

¹⁸ Zu Hans und Peter Pötschner: Oefele 1878, 537, 563.

Tabelle 4. *Reichtum in den Gassen und Vierteln (München 1397).*

	427 / 569 fl	711/1422 fl	>1422 fl
Sendlinger Gasse	1		
Althaim	1	1	
Neuhauser Gasse	3	1	
Engengasse	1	1	
Schaefflergasse	1		
Kreuzgasse	2		
Schwabinger Gasse pr.	2	1	
Schwabinger Gasse sek.	1		
Tal prima Marie	3		1
Tal St. Peter	2		
Kernstadt St. Peter	14	13	11
Kernstadt St. Marien	21	15	2
Zahlen insgesamt	52	32	14

gelegen um die Ausfallstraße von St. Peter nach Südosten zum Isartor. Es kann zu den besseren Stadtteilen gezählt werden, weil es neben einem hohen Anteil Bedürftiger (Tabelle 3) eine relativ breite Schicht gut gestellter Handwerker-, Krämer- und Kaufleut Haushalte (ca. 200–427 fl Steuervermögen) aufwies. Inmitten dieses von gewerblichen Strukturen charakterisierten Raums lag einem Solitär gleich das Stadthaus des Rats Herrn Gabriel Ridler, eines der reichsten Münchner Haushalte der Zeit (3834 fl Steuervermögen, (ebd., f. 28v.). Doch räumliche Nähe der Reichen — Ähnliches wurde in Fribourg und Basel oder in Rothenburg ob der Tauber und Schwäbisch Hall beobachtet¹⁹ — hieß nicht soziale Konnektivität, sondern permanente Reproduktion der weiten sozialen Rangunterschiede.²⁰ Gabriel Ridlers Sozialpraxis und sein Rang als Angehöriger eines der ältesten Stadtadelsgeschlechter der Residenzstadt unterschied sich gewaltig von den bescheidenen Lebensformen seiner Nachbarn, des von ihm angestellten Schreibers Hans Offung (35,5 fl Steuervermögen), eines Malers (55 fl) und eines gewissen Chunrad Grell (36,8 fl).

Man könnte sagen: Gerade weil Gabriel Ridler inmitten des gewerblichen Quartiers im Graggenauer Viertel, besetzt vor allem mit Schmieden, Wagnern, Wollschlägern, Webern, Färbern und vielen Flößern, residierte und als großer Mäzen des Siechenhauses galt (Dirlmeier 1978, 519f.), war er beim Aufstand der Handwerker und kleinen Leute Münchens 1397/98 als Mitglied des alten Rates politisch derart exponiert,

dass er mit Konrad Diener und dem im kernstädtischen Tal Petri (Angerviertel) wohnenden Ludwig Pötschner dem Jüngeren (622 fl; StadtA München, Steuerbuch 1397, f. 36v; Oefe 1878, 511). inhaftiert wurde (ebd., 470, §§ 31–34; Kazmairs Denkschrift). Drei weitere Ratsherren ließen die Aufständischen gleichfalls suchen: Matthias Sentlinger aus dem Viertel um die Frauenkirche, wo er unter Bäckern, Krämern, Kornmessern und Malern Haus und Hof hatte (StadtA München, Steuerbuch 1397, f. 39v; Oefe 1878, 520f.), Hans Schluder (1493, 3 fl; StadtA München, Steuerbuch 1397, f. 36v; Oefe 1878, 521.), den Nachbar Pötschners, und Ulrich Ebner (970 fl), ebenfalls wie Sentlinger bei der Frauenkirche am Rindermarkt ansässig (StadtA München, Steuerbuch 1397, f. 34v; Oefe 1878, 522.) Sentlinger und Schluder waren wenige Tage vor der Aktion am Ende des Jahres 1397 auf das Landgut Sentlingers in Pähl am Ammersee geritten und Ebner hielt sich in Venedig auf. Sie entkamen ihren Häschern auf diese Weise, man verbannte sie in Abwesenheit aus der Stadt. Doch keine soziale Regel ohne Ausnahme: Der vermögende Ratsherr Ulrich Tichtl (817 fl) schwang sich zum Kopf der Revolte auf. Er wohnte ebenfalls im kernstädtischen Quartier um die Frauenkirche und lebte dort wie fast alle seine Gegner aus der Stadtelite mitten unter Handwerkern — der Schuster Wendel Spiegel (17,7), der Schneider Maisel (35,6 fl) und der Kürschner Otlet von Haidhausen (71,1 fl) waren seine unmittelbaren Nachbarn (StadtA München, Steuerbuch 1397, f. 37v.).

Im Steuerbuch Münchens von 1397 fallen überdies Clusterbildungen von kleinen Handwerksbetrieben, aber auch von Reichen auf — trotz der vorherrschenden sozialen Durchmischung der urbanen sozialen Gruppen bei allem inhomogenen Gegeneinander ihrer Lebensformen. An dem gerade genannten Rindermarkt im kernstädtischen Frauenkirchenviertel lagen nebeneinander mehrere Häuser von Stadtadels- und Ratsherrengeschlechtern (StadtA München, Steuerbuch 1397, f. 34v.), die Anwesen von Hans Tichtl (557 fl Steuervermögen), von Hans Rudolf, dem schon genannten reichsten Münchner (4849 fl; Dirlmeier 1978, 512–514), von Bartholomäus Schrenck (1626,7 fl; ebd., 518) und Hans Püttrich, nächst Rudolf dem Zweitreichsten (4844 fl; ebd., 511). Alle wurden mit Ausnahme von Hans Tichtl vom aufständischen Rat 1398 aus München verbannt. Ihre Häuser dürften keine städtischen Prachtbauten gewesen sein, wie sie im 16. Jh. im Stil der Hoch- und Spätrenaissance errichtet werden sollten. Das Anwesen des Bartholomäus Schrenck etwa war vielmehr wie das Runtinger-Haus

19 Mit der entsprechenden Literatur: Dirlmeier/Fuhrmann 2005, 435.

20 Dazu auch: Dirlmeier/Fuhrmann 2005, 436.

in Regensburg oder das Melem-Haus in Frankfurt ein großes Kauffahrteihaus mit Kaufläden im Erdgeschoß, die Schrenck vermietete (ebd., 518).²¹

Ausgesprochene Clusterbildungen der Steuerzahler zwischen 41 und 60 Pfennig (12,1–17,8 fl Steuer Vermögen), was heißt: vor allem handwerklicher Alleinbetriebe, gab es in allen Quartieren, vor allem und ganz selbstverständlich in den wenig bevölkerungsreichen Vorstadtsiedlungen. Im Viertel „Vor dem Spital“ (vor dem Heilig-Geist-Spital auf dem heutigen Viktualienmarkt), das als typisches Beispiel solcher Quartiersbildungen dienen mag, zahlten 16 von den 27 Steuerpflichtigen Beträge in jenem Bereich sehr kleiner Vermögen bzw. Einkommen (StadtA München, Steuerbuch 1397, f. 1v.). Diese Haushalte — darunter in identifizierbaren Berufen: drei Maurer, ein Koch, ein Karrer, ein Holzhacker, zwei Fischer und ein Schmied — wohnten in drei Clustern: zweimal zu dritt bzw. einmal zu zehnt nebeneinander.²² Alle mit Ausnahme von Cunzel, dem Maurer, und dem Karrer Engel, verfügten über kleine Häuser. Sie zahlten daher Vermögensteuer, aber taten dies, wie oben schon erwähnt, in unterschiedlich ausgehandelter Höhe — 60 Pfennige für vier, fünf, sechs oder neun Pfund Pfennig Vermögen. Das verdeutlicht noch einmal, dass bei der Steuererhebung neben den Vermögenswerten auch die jeweilige zwischen Steuerern und Steuerpflichtigen

verhandelte Einkommenssituation entscheidend war. Und ein zweiter Umstand wird hier wie in allen Münchner Quartieren deutlich: Es gab wie allgemein keine ausgesprochenen Ballungen einzelner Berufe oder Berufsgruppen, sieht man von den sehr allgemeinen Konstanten der bevorzugten Quartiere des Handels in Innenstadtlagen und der Verkehrsgewerbe in Vorstadtsituationen ab. Selbst in der Münchner „Kornpecker Gasse“ saßen 1397, soweit dies zu erkennen ist, keine Bäcker, sondern Lebküchner, Fuhrleute, Maurer, Kalkbrenner, Taschner und Krämer (StadtA München, Steuerbuch 1397, f. 12v f.). Lediglich feuergefährliche oder geruchsintensive Sparten wie die Gerberei hat man tunlichst geschlossen in peripheren Lagen der Städte angesiedelt.²³

Unter den vier Steuerpflichtigen, die in der Vorstadt „Vor dem Spital“ mittellos waren bzw. in großer Armut ihr Leben verbringen mussten, finden sich auch zwei Frauen: Ann Haffner, sie war bettelarm und verfügte über kein steuerlich relevantes Vermögen, und Els Mawrman, sie zahlte nur 18 Pfennige, versteuerte mithin nur ein Einkommen von 5,3 rheinischen Gulden.

Ann und Els und mit ihnen insg. 263 Münchnerinnen wurden 1397, soweit dies aus den Namen im Steuerbuch ersichtlich wird, zur Steuer veranlagt (Tabelle 5). Das entsprach einem Anteil von 11,6 % der Steuerzahler.

Tabelle 5. Frauen als Steuerzahlerinnen (München 1397).

d	0	40	60	90	150	180	270	330	960	1440	1920	2400	4800	>4801
Z	33	104	72	12	13	5	3	3	10	2	2	1	1	1
%	12,5	39,5	27,4	4,6	4,9	1,9	1,1	1,1	3,8	0,8	0,8	0,4	0,4	0,4

d Numerische Anteile; Z Zahl der Steuerzahlerinnen; % Prozent. Verteilung der Steuerzahlerinnen.

Unter den 263 Münchnerinnen befanden sich 168 Frauen, die als Witwen bezeichnet wurden. Vermögen in Form von Immobilien, die wohl in der Regel Grundlage der steuerlichen Selbsteinschätzung bildeten und von den Steuerern unabhängig vom Steuerbetrag notiert wurden, besaßen 94 oder rund 36 % der Frauen. Die übrigen wurden auf Grundlage ihrer Einkommenssituation besteuert. Die unterschiedlichen Besteuerungsgrundlagen erschweren die Einordnung von Vergleichszahlen aus anderen Städten, so wenn man für

Wien im Jahre 1448 feststellte, dass etwas mehr als 6 % aller Haushaltsvorstände Witwen waren, wovon etwa die Hälfte ein Haus ihr Eigen nannte (Ertl 2020, 130).

Die soziale Ungleichheit unter den Einwohnerinnen und Bürgerinnen entspricht ungefähr der allgemeinen Situation in München um 1400 (Tabelle 5). Die Dimensionen der Spannbreite reichen von der als „pauper“ bezeichneten Witwe Ryemerin, die wie 12,5 % der Frauen kein Einkommen besaß und neben dem öffentlichen Frauenhaus im Angerviertel am Austritt des Großen

21 Zu den genannten Häusern im Überblick Fouquet 1998, 409–417.

22 Die Kohorte der zehn Haushalte wurde unterbrochen von Ebert, einem Maurer, der kein Haus besaß, aber 53 fl Einkommen versteuerte. Die zweite Kohorte der

drei Haushalte befand sich in dem kleinen Quartier vor dem „Schiner Tor“, das zu diesem Viertel gezählt wurde (StadtA München, Steuerbuch 1397, f. 1v.).

23 Mit weiterer Literatur Dirlmeier/Fuhrmann 2005, 428–431.

Angerbachs aus der Stadtmauer wohnte, über einen hohen Anteil von Frauen, die mit weniger als 12 bzw. 18 rheinischen Gulden auskommen mussten und mit hin in sehr armen bzw. prekären Verhältnissen lebten.²⁴ Am glücklicheren Ende der Skala versteuerte die Witwe Wilbrechtin 1760 rheinische Gulden, sie stammte aus einem bekannten Geschlecht im Petersviertel (StadtA München, Steuerbuch 1397, f. 5v u. 35r.).²⁵

In München wie anderswo: Witwen wurden grundsätzlich nach ihren verstorbenen Männern benannt, lediglich unverheiratete Frauen besaßen in amtlichen Dokumenten ihren Vor- und Herkunftsnamen (Ertl 2020, 138 f.). Es fällt von daher schwer, etwas über weibliche Berufe zu sagen. Die mittellose Agnes Weberin am Rossmarkt dürfte das Weberhandwerk, einen der typischen Frauenberufe, ausgeübt, die mit 178 rheinischen Gulden Steuereinkommen wohlhabende Witwe Zimmerin in der Sendlinger Gasse dagegen vielleicht nur den Zimmereibetrieb ihres verstorbenen Mannes weitergeführt, die zusammen mit ihrer Tochter veranlagte Witwe Sewslaherin im Frauenkirchenquartier wohl

kaum sich in diesem Beruf verdingt (StadtA München, Steuerbuch 1397, f. 6r, 7r u. 38v.),²⁶ die unverheiratete und mit eigenem kleinen Haus im Frauenkirchenviertel besteuerte Gred Kursnerin dagegen wie neun andere Frauen vornehmlich im Frauenkirchenviertel als „chauflin“, als Krämerin, Kleinhandel mit allerlei getrieben haben.²⁷ Auffallend ist, dass gelegentlich Ehefrauen wie die „uxor“ des Schusters Andre Hilflach im Petersviertel (StadtA München, Steuerbuch 1397, f. 36r.) als selbständige Haushaltsvorsteherinnen von den Steuerern wahrgenommen wurden, weil sie über eigene, von der Männerseite getrennte Einkommen verfügten. Die sozialtopographische Verteilung selbständiger weiblicher Haushaltsvorstände ähnelt ebenfalls dem allgemeinen Bild: Wohlhabenheit und Reichtum ist, von Ausnahmen abgesehen, Angelegenheit der Kernstadtviertel um Frauenkirche und St. Peter, allerdings im Quartier an der Frauenkirche mit einem auffallenden Anteil an völlig mittellosen Frauen (sieben von 35 weiblichen Haushaltsvorständen).

FAZIT

Als kurzes Fazit am Ende einer exemplarischen Untersuchung von über 2000 Namen und Steuerbeträgen aus der Residenzstadt München im politisch unruhigen Jahr 1397: Steuerbücher eignen sich für die Fragestellung nach den weiten Dimensionen von arm und reich, nach den zeitgenössischen Größenverhältnissen der betroffenen sozialen Gruppen, die unterhalb der Armuts- und Bedürftigkeitsgrenzen, ja des Existenzminimums lebten, sowie nach der sozialtopographischen Verteilung von Armut und Reichtum im Stadtraum nur dann, wenn neben der als direkte Steuerart üblichen Vermögensteuer auch die Einkommen aller Stadtbewohner ab einer festgelegten Mindestgrenze besteuert wurden. Damit erst wird außer dem Klerus und den Bediensteten der Großteil wirtschaftender Männer und Frauen in den Städten sozialgeschichtlich sichtbar. Offen bleiben dabei allerdings Fragen, wie man zeitgenössisch mit dem Umstand umging, dass wie in München rund 83 % der Städter, darunter die Masse der selbständigen

Frauenhaushalte, unterhalb der Armutsgrenze lebten und fast 5 % der Steuerpflichtigen gänzlich mittellos waren. Breit wirksame soziale Instrumentarien gab es im Mittelalter nicht, sie entwickelten sich auch nicht mit der Zeit. Offen bleibt außerdem, wie sich in den räumlich engen Stadtquartieren das intime und, wie beobachtet, nur innerhalb weniger Cluster sowie in einigen vorstädtischen Milieus kleiner handwerklicher Alleinbetriebe lediglich in Ansätzen segregierte Zusammenleben zwischen den völlig unterschiedlichen sozialen Praktiken von Reichtum und Armut im Alltäglichen organisierte. Räumliche Nähe jedenfalls, das fiel auf, bedeutete keine soziale Konnektivität, sondern permanente Reproduktion der weiten Rangunterschiede. Ob sich diese Fragen lösen ließen, wenn ganze Steuerbuchserien, die den genannten Vorgaben einigermaßen entsprächen, erschlossen und mit digitalen Werkzeugen analysiert würden, steht dahin. Ein Versuch jedenfalls wäre es wert.

24 Zu diesen Sozialgruppen am Beispiel von Treviso: Scherman 2021, 205–218.

25 StadtA München, Steuerbuch 1397, f. 5v u. 35r.
Zu Wilbrecht: Dirlmeier 1978, 514 f.

26 Zu den „typischen“ Frauenberufen (Textil- u. Nahrungsgewerbe) unter den in 43 Neubürgerbüchern des Alten

Reiches aufgenommenen Bürgerinnen: Studer 2002, 185.

27 StadtA München, Steuerbuch 1397, f. 9r (Sendlinger Gasse); 16v (Engengasse); f. 36r (St. Peter); 37v, 38v, 39r und 40v (Frauenkirche). Zu weiblichen Berufen jüngst am Beispiel von Rouen und ihren ähnlich wie in Köln freien weiblichen Handwerksassoziationen Rivière 2023.

QUELLEN UND LITERATUR

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Manifesting the Socio-economic Modalities of the Anatolian Town Model

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KEYWORDS: urbanisation, Mesopotamia, Anatolian town model, farming, environmental setting

Abstract

The emergence and the development of urban centres in the Near East have customarily been viewed through the processes taking place in Syro-Mesopotamia. The adverse environmental conditions of this semi-arid region necessitated irrigated farming, which, while providing surplus food, also required large labour forces consequential to crowded settlements and, of course, strict manipulation of the workforce. In this respect, the need for raw materials and various natural resources gave rise to a strict but complex system of governance run by clerics, organising surplus products as surplus value to provide materials absent in Syro-Mesopotamian arid environments. Thus, crowded town centres developed in Mesopotamia with clear markers of social stratification, and monumental temples domineered the urban environments as the manifests of power. In contrast, throughout prehistory, Anatolia was sustained by dry farming with no need

for surplus products for domestic consumption. However, Anatolia developed a socio-economic model dependent on the demands of semi-arid regions by its southern borders, thus becoming one of the main suppliers for all sorts of raw materials and products lacking in Syro-Mesopotamia, developing long-distance trade systems. Eventually, the processes of urbanisation that took place in Syro-Mesopotamia and Anatolia developed on different lines, the particularities of socio-economic infrastructures being notably different from the others. In strong contrast to crowded, imposing urban centres of the southern flatlands, Anatolian towns, mainly through the 4th and 3rd millennia, were small, lacking temples but having palaces instead — this model, best attested in late 4th–4th millennium with Arslantepe being the forerunner of later Anatolian towns. This paper will present a conspectus of the Anatolian town model.

Zusammenfassung

Die Entstehung und Entwicklung der urbanen Zentren im Nahen Osten wird traditionell durch die Prozesse in Syro-Mesopotamien betrachtet. Die widrigen Umweltbedingungen dieser semiariden Region erforderten eine Bewässerungslandwirtschaft, die zwar einen Überschuss an Nahrungsmitteln liefert, aber auch viele Arbeitskräfte erfordert, die zu überfüllten Siedlungen und natürlich zu einer rigorosen Steuerung der Arbeitskräfte führten. In dieser Hinsicht schuf der Bedarf an Rohstoffen und verschiedenen natürlichen Ressourcen ein strenges, aber komplexes Regierungssystem, das von Klerikern geleitet wurde und Mehrprodukte als Mehrwert organisierte, um Materialien bereitzustellen, die in den trockenen Gebieten Syros-Mesopotamiens fehlten. So entstanden in Mesopotamien überfüllte Stadtzentren mit deutlichen Anzeichen sozialer Schichtung — und monumentale

Tempel dominierten die städtische Umgebung als Manifeste der Macht. Auf der anderen Seite wurde Anatolien während der gesamten Vorgeschichte von Trockenlandwirtschaft versorgt, ohne dass überschüssige Produkte für den Inlandsverbrauch benötigt wurden. Anatolien entwickelte jedoch ein sozioökonomisches Modell, das von der Nachfrage aus den semiariden Regionen an seinen südlichen Grenzen abhängig war, und wurde so zu einem der Hauptlieferanten für alle Arten von Rohstoffen und Produkten, die in Syro-Mesopotamien fehlten, und zur Entwicklung von Fernhandelssystemen führte. Im Laufe der Zeit entwickelten sich die Urbanisierungsprozesse in Syro-Mesopotamien und Anatolien in unterschiedlichen Richtungen, wobei sich die Besonderheiten der sozioökonomischen Infrastrukturen deutlich von den anderen unterschieden. Im Gegensatz zu den

überfüllten, imposanten städtischen Zentren des südlichen Flachlandes waren die anatolischen Städte, vor allem im 4. und 3. Jahrtausend, klein, ohne Tempel, sondern mit Palästen — dieses Modell, das am besten im

späten 4. und 4. Jahrtausend bezeugt ist, ist am besten in Arslantepe dem Vorläufer der späteren anatolischen Städte belegt. Der Beitrag wird einen Überblick über das anatolische Stadtmodell geben.

PREAMBLE

Since the early years of research, it had been almost conventional to consider the emergence and development of urban centres and city-states through a Mesopotamia-centric perspective. Even by the 3rd millennium BCE, the Near East urban centres featured crowded centres covering extensive areas adorned with imposing monumental temple complexes. Syro-Mesopotamian towns were set by clearly differentiated sectors, such as the workers' quarters that signify the highly stratified social ordering of the time, which can justifiably be generalised as a surplus economic model run by an institutionalised bureaucratic setup. However, on the other hand, Early Bronze Age Anatolian settlements had developed on a different line than what we have noted for Syro-Mesopotamia.

Firstly, all contemporary settlements of Anatolia were incomparably small, both in population and size, lacking imposing monumental temples, storehouses, workshops and the indicators of a bureaucratic setup. Despite their modest appearance, Anatolian centres were encircled by massive walls with monumental gateways and, thus, could no longer be addressed as villages. Even if there always was a consensus in addressing 3rd millennium Anatolian centres as “towns”, the presence of complex metallurgy in Anatolia stood as the prime criterion in this denotation (Mellaart 1978; Jukowsky 1996; Efe 2002). Likewise, Bittel's categorisation of Early Bronze Age Anatolian pottery into distinct groups (Bittel 1942) has mostly been taken as them being the products of different political units, thus indicating a pre-literate complex social setup (Lloyd 1956; Mellaart 1966; Alkim 1968). Looking at Anatolian

towns through the perspective of the urbanisation process seems to be confined to Late Chalcolithic cultural centres of Southeast Anatolia, primarily to the palatial system as best evidenced by Arslantepe (Yakar 1985; Özyar 1999), however still, the rudimentary state of 3rd millennium Anatolian settlements as being small in size has often been noted (Naumann 1955). It is only during the last two decades or so that in discussing the issue of urbanisation in Anatolia, socio-economic modalities particular to Anatolia came to be considered as being different from Syro-Mesopotamian (Çevik 2004; Çevik 2007; Erarslan 2008; Sagona and Zimansky 2009; Şahoğlu 2019). In the medium of those discussions, we suggested that Early Bronze Age Anatolian settlements must be looked at using criteria particular to the region. We proposed a new descriptor, the “Anatolian town model”. We had based our proposition on the differences between the urbanisation processes of Anatolia and Syro-Mesopotamia, arguing that the Anatolia towns were not derivatives of the Syro-Mesopotamian model but had developed independently of them being seminal to the socio-economic conditions of Anatolia (Özdoğan 2006). We had drawn attention to the conditions that led to the emergence of crowded, socially stratified Syro-Mesopotamia settlements that differed from those of Anatolia. Thus, judging them based on the same criteria would be wrong and misleading. Accordingly, we proposed the Anatolian Town Model as a new concept to consider. Through time, our concept, though occasionally criticised, seems to have found general acceptance; we now consider it the time to elaborate further and define regional variants.

FARMING VILLAGES THAT SUSTAINED AS SIMPLE FARMING COMMUNITIES

By the turn of the 6th millennium BCE, small to medium-sized farming communities had already been established almost all over the Anatolian peninsula and the neighbouring regions. These settlements were founded either by the migrating farmers from the core areas of incipient neolithisation in south-eastern Anatolia or by local groups acculturated through interaction with them. Accordingly, more or less, they all had the same primary components of the so-called “Neolithic package”: cultivated plants, domesticated animals and essential utilitarian technologies. However,

these newly founded settlements lacked the complexity of those in the core areas, particularly of the Upper Tigris — Upper Euphrates regions, particularly notable with the absence of a hierarchic setup of living and imposing communal structures. Anatolian settlements of that era can justifiably be addressed as simple farming communities as they lacked intricate status objects reflecting competitiveness among elites, innovativeness and the social momentum to change. Nevertheless, this does not imply that they were identical, but regional and local variants were apparent from

the earliest stages on. It should not be overlooked that the composition of the actual material assemblages of these settlements varied according to the specific area of origin of the migrants and to which they had joined the movement. In this respect, we exemplified the similarities and diversities among the contemporary Neolithic packages of eastern and western Marmara groups (Özdoğan 2010, 2014b). Differences were mainly on the ratio or typology of various artefact groups, such as the scarcity or abundance of figurines or celts, subsistence patterns, leaving aside the changing importance of pigs and marine sources; otherwise, the prime component of the assemblages was much alike.

By the beginning of the 4th millennium BCE, farming villages were established almost all over Anatolia and in neighbouring regions, with already regional variants becoming apparent. The main divide seems to be between the northern and southern halves of the peninsula, with those on the northern section displaying a less complex social structuring than those of the south, particularly apparent in the modalities in the use of pottery vessels. South-eastern parts of the peninsula, the homeland of the so-called “Göbeklitepe Culture” along the upper Euphrates and upper Tigris basins, after a time of cultural breakdown following the Pre-Pottery collapse, had positioned again as a pacesetter in socio-economic happenings. The region's cultural revivification is most apparent during the so-called “Hassuna-Halaf” transitional period, around the 6th millennium. It is taken as a model in considerably large geography by its painted pottery and other status objects (Özdoğan 2014a, 1523). However, despite the apparent diffusion of stylistic issues such as covering the inner surfaces of open-shape dishes with painted decoration, settlements that mushroomed in the western parts of the peninsula beyond the area of primary neolithisation continue without manifesting any indication of developing social complexity. Further away from the old core, the decline in elite competitiveness and innovativeness became more apparent, with settlements living on as simple farming communities. On

the other hand, cultural dynamism and momentum to change are apparent in Southeast Anatolia, particularly from the Early Halaf on.

During that time, a demographic build-up was marked by the increase in the number and size of settlements and by settling in regions conventionally considered unfavourable for developing complex cultures. In this respect, through our surface surveys, we had been somewhat astonished by the intensity and magnitude of Halaf sites in the diversity of environments, as up to that time, we were strongly biased by considering Southeast Anatolia as being marginal to the Halaf cultural sphere flourishing in northern Syria and Iraq. The largest Halaf site we had encountered was at Samsat, one of the gigantic multi-layered sites of the Near East, with Halaf sherds occurring all along its periphery, signifying a Halaf settlement of at least 500 m in diameter (Özdoğan 1977, 133). Likewise, recovering Halaf sites on a macro-scale during the Keban Project rescue operations at Altınova, along the intermountain plains north of the East Taurus range, previously considered as being outside of the domain of Halaf Culture (Özdoğan 2020), and also on the rugged regions along the mountains had all been implemental in reconsidering the core area of Halaf tradition (Özdoğan and Karul 2002); likewise, excavations at another Halaf site of extensive dimension, Domuztepe, have revealed outstanding finds of artistic depictions (Tekin 2016). The western border of Halaf culture is somewhat problematic; those along the Amuq plain and Cilicia have occasionally been addressed as “Halaf related”, not signifying the difference. Various contemporaries further west in Anatolia and almost all over the Balkans, also known by their painted potteries, have occasionally been directly or indirectly suggested to be related to Halaf tradition (Schachermeyr 1976; Irving 1999). Nevertheless, it can justifiably be concluded that a simple farming way of living, though with regional variants, prevailed in most of the Anatolian peninsula while south-eastern regions were already laying the basis of complex social structuring to come.

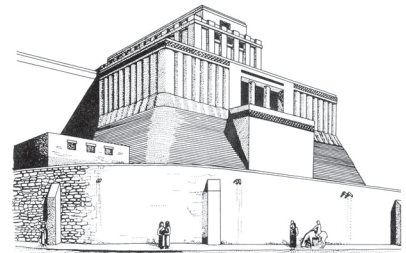
CHANGING MODALITIES AND THE SETTING OF ANATOLIAN TOWN MODEL

By the late stages of the Pottery Neolithic era, it is more or less evident that southeast Anatolia began to lose its role as a pacesetter, with regions further to the south taking the lead. In the early stages of Ubaid Culture, while the complex social structure was consolidating in the south, the southeastern parts of the Anatolian peninsula were featured by the so-called “scored wares” rather than coarse chaff-faced pottery. However, during that time, the emergent surplus economics of Syro-Mesopotamia began looking for raw

materials and markets. Several sites in northern Syria and south-eastern Turkey, among them, Değirmentepe and İmamoğlu both in the region of Malatya, manifest the expansion of the organised Ubeid trade system (Özdoğan 1977; Esin 1989; Esin 1998). The excavations at Değirmentepe, in particular, have revealed a rich assemblage of bullae, impressions of stamp seals signifying an account-keeping system of long-distance trade, along with a typical tripartite building in South Mesopotamian style (Esin 1994). The trade network of the

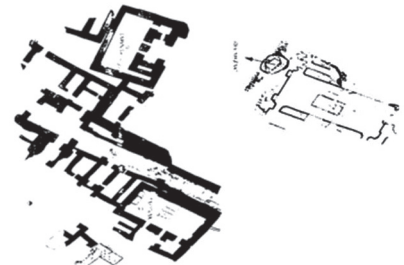
SYRO-MESOPOTAMIAN TOWN MODEL

TEMPLES AND CLERGY
STATES WITH BOUNDARIES
CROWDED TOWNS WITH WORKERS QUARTERS



SOUTH EAST ANATOLIAN TOWN MODEL

PALACES AND KINGS
TOWN MAINLY PALATIAL COMPLEX
RECORD KEEPING



ANATOLIAN TOWN MODEL

CHIEFTAINS - MEGARONS
SMALL BUT FORTIFIED SYMBOLIC TOWNS
PRIVATE CRAFTSMEN

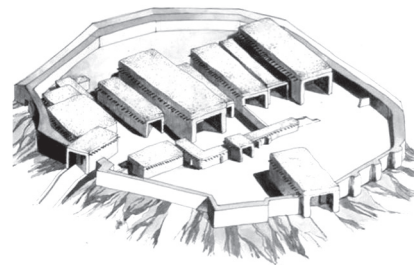


Fig. 1. Schematized comparison of different town models reflecting socio-economic settings.

Ubaïd system seems to have a considerable expansion among the northern fringes of the East Taurus range, as evidenced at Tülintepe in the region of Elazığ on the eastern side of the Euphrates (Özdoğan 2020). The pace of interaction between the Upper Euphrates region and Syro-Mesopotamia accelerated by the Uruk period during the 4th millennium BCE. Several Uruk colony settlements have been founded in various parts of Southeast Anatolia, among those Hassek Höyük and Hacinebi (Behm-Blancke 1991; Stein et al. 1996; Helwing 1999; Stein 1999, 2002; Rothman 2011).

While Uruk colonies were being established in northern Syria and south-eastern Turkey, a significant socio-economic system was developing at the intermountain plains along the northern fringes of the East Taurus range, best evidenced at Arslantepe. Excavations at Arslantepe have exposed a complex compound of palatial systems, evidencing a local administrative system in complete control of local resources and turning them into assets for organised trade (Frangipane 1997; Frangipane 2012; Balossi-Restelli 2019). It also became evident that the ruling system at Arslantepe was not only exploiting all sorts of raw materials, including native copper, but also importing other raw materials, making alloys and manufacturing artefacts by employing complex technologies. Notably,

arsenic-copper and tin are among the imports from far-distant geographies (Palmieri et al. 1993; Di Nocera 2010). The most outstanding finding of Arslantepe, as different from Syro-Mesopotamia, has been the manifestation of governance by a palatial system and not of a temple. However, Arslantepe's staple-economic model efficiently manipulates sources without needing an extensive labour force (Frangipane 2011, 2018). Thus, the 4th millennium citadel of Arslantepe, though comprising a small temple, a throne room, storerooms, and an archive chamber, is incomparably smaller than contemporary Mesopotamian urban centres, setting the modalities of what will be dominant during the 3rd millennium BCE as the "Anatolian town model".

The Anatolian town model

The 3rd millennium BCE has justifiably been addressed by Andrew Sherratt as the "time of change" in Anatolia, signifying the consolidation of the Anatolian town model, making it possible to distinguish villages from towns (Sherratt 1993; Alram-Stern 2012). It was also when the divide between the Syro-Mesopotamian and Anatolian town models became more apparent (Fig. 1). As already noted above, since its early beginnings,



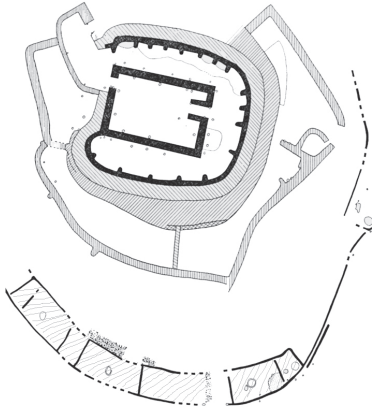
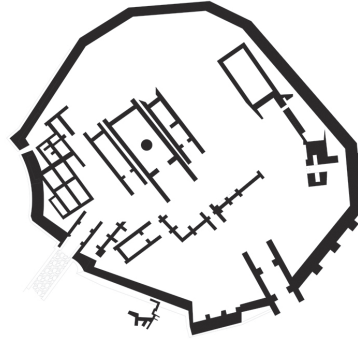
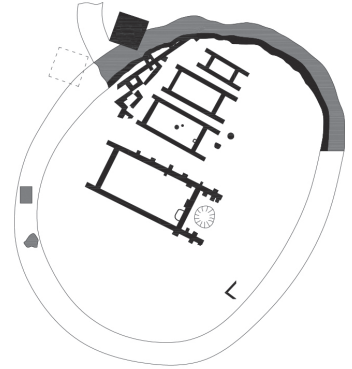
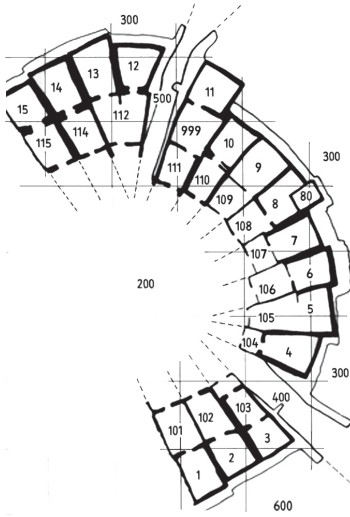
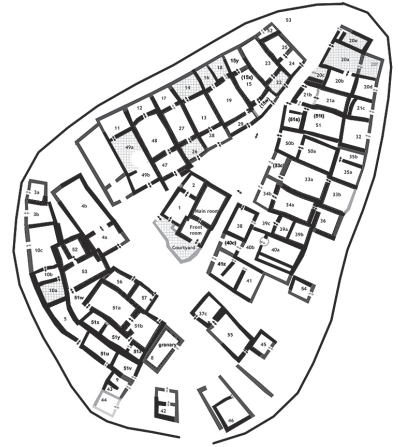
Fig. 2. Kanlıgeçit, Phase 3, megarons within the walled citadel (Photo: Thrace Research Centre Archive).

farming in Anatolia has been on a household level, not necessitating to employ seasonal workers. However, Syro-Mesopotamian towns became populated, firstly by the seasonal workers becoming residential and then services needed to maintain the system's running. Anatolian towns remained incomparably smaller and less populated than Syro-Mesopotamian urban centres simply because the Anatolian economy was not dependent on irrigated farming; thus, there was no need to have large labour forces. In this respect, Anatolian towns were not designed to populate urban centres but to signify the local governance system. From the onset of Early Bronze Age I, early 3rd millennium on, fortified small towns, mainly comprised of rectangular buildings of the so-called "megaron type", mushroomed almost all over the Anatolian peninsula except for Southeast parts bordering Syria.

The towns in Syro-Mesopotamia reflect the hierarchic ordering of the upper-class elites; monumental temples with annexed stores, workshops, *etc.*, sitting at the very heart of cities, signifying the power of the ruling clergy. The emergence of an elite ruling group during the Bronze Age is also evident in Anatolia; however, its reflection on social organisation and the setting of settlements developed in a different trajectory than that of Syro-Mesopotamia. The edifices of the ruling elite stood in Anatolia are more symbolic, towns lacking monumentality and other social indicators of

the ruling elite. Despite being small, with dimensions from 35–200 m, Anatolian towns were encircled by defensive systems with monumental gateways, lacking palatial residences, imposing temples, storage facilities or workshops. Instead, they had few megaron-type free-standing buildings and ceremonial courtyards (Fig. 2, Fig. 3). The main habitation was outside the enclosure walls, as a sporadic spread of houses. Workshops, likewise, were outside of the walled citadels, indicating that crafts were somewhat run by private enterprise, loosely controlled by the citadels. The Anatolian town model was sustained up to the end of Early Bronze Age (EBA) II. However, with the increased pace of commerce and long-distance caravan trade, the Anatolian citadel began gradually adapting the modalities of Syro-Mesopotamian urban centres. Thus, by the Early Bronze Age III, Anatolian settlements such as Kültepe, Seyitömer, Hacilar Büyüktepe and Küllüoba that are located along the scope of Near Eastern trade routes began incorporating residences, if not palaces, storage facilities and relatively more houses (Efe 2003; Sarı 2013). However, by the end of the Early Bronze Age, Anatolian towns lacked monumentality, imposing structures, temples, workshops and workers' quarters. Only by the turn of the Early to Middle Bronze Age did palaces in the true sense of their meaning appear in Anatolian towns, as best exemplified at Norşuntepe.

ANATOLIAN TOWN MODEL RADIUS: 35-150 M

**ELMALI****TROYA****KANLIGECIT****DEMIRCIHOYUK****PINARLAR-PULUR****SEYITOMER****BADEMAGACI****HACILAR-BUYUKTEPE***Fig. 3. Selected sites of EBA Anatolian towns, not to scale.*

FIRST HALF OF 3 rd MILLENNIUM BC	
NEAR EASTERN TOWN MODEL	ANATOLIAN TOWN MODEL
STRONG GOVERNANCE	REGIONAL RULERS
LARGE TOWNS	SMALL TOWNS
SATELLITE SETTLEMENTS	CENTER AND SCATTER OF FARMS
ADMINISTRATIVE COMPOUNDS	ADMINISTRATIVE BUILDING
MONUMENTAL TEMPLE	MONUMENTAL CITY GATE
DEFINED COMMERCIAL ZONE	TRADERS, BARTER
WORKSHOPS, STOREHOUSES	WORKSHOPS EXTRAMURAL
WORKERS QUARTERS	NO WORKERS QUARTER
PROFESSIONAL DEFENCE SYSTEM	SYMBOLIC DEFENCE SYSTEM
VARIOUS STRUCTURES	MEGARON
QUARTERS, STREET SYSTEM	NO DEFINABLE QUARTES
LOWER TOWN	SCATTER OF HOUSES

Fig. 4. Comparative chart of Near Eastern and Anatolian town models.

FINAL NOTES

An overall assessment now defines two or even three distinct town models for prehistoric Anatolia and its neighbouring regions. The first is the accustomed and well-defined model of Syro-Mesopotamia, which has had a long formation process since the Ubaid period. During this stage, surplus products from irrigated farming began to have consequences, setting up a socio-economic system based on a surplus economy, intensive workforce, institutionalised trade, and bureaucratic organisation over time. By the early stages of the 3rd millennium BCE, urban centres in macro dimensions were evident all over Syro-Mesopotamia, becoming the primary model of urbanisation in the Near East by the 2nd millennium BCE.

The Anatolian town model differs from Syro-Mesopotamian centres in all aspects; it is incomparably smaller in size and population and lacks monumental

civic centres and sanctuaries (Fig. 4). The pristine form of the Anatolian Town Model developed by the 4th millennium BCE along the northern fringes of Syro-Mesopotamia, in regions rich in sources of raw materials and, more importantly, where the local communities were technologically advanced enough to use them in manufacturing artefacts as best exemplified at Arslantepe. Accordingly, the second system was based not on clergy but on managing local sources by local rulers. Thus, controlling production and trade did not require a large population. What prevailed in Anatolia throughout the Early Bronze Age is a direct derivative of the Arslantepe model. However, it is also clear that as long-distance trade intensified by the end of the 3rd millennium BCE, the Anatolian town model gave way to that of the Syro-Mesopotamian model.

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A Haunting Spectre Goes Geophysical

Wolfgang Rabbel

KEYWORDS: magnetic prospecting, magnetic inversion, numerical modelling, Tripolje houses, evaluation of magnetic measurements, daub

Zusammenfassung

Die magnetische Kartierung vorgeschichtlicher Siedlungen kann zur Erforschung sozialer Strukturen vergangener Gesellschaften beitragen, wenn es gelingt aus den Messungen die Architektur, Größe, Häufigkeit und Anordnung der Gebäude hinreichend genau zu bestimmen. Im Gegensatz zu Grabungen und Bohrungen, die stets Stichprobencharakter haben, sind geophysikalische Kartierungen in der Lage, Siedlungsareale vollständig zu erfassen, so dass statistische Analysen sich auf erheblich vergrößerte Grundgesamtheiten stützen können. Vor diesem Hintergrund wurden in den letzten Jahren Auswertemethoden entwickelt, die es erlauben, die im Boden noch vorhandenen Massen von magnetisiertem Material zu bestimmen. Für steinzeitliche Gebäude, die aus Holz, Flechtwerk und Lehm konstruiert und nach der Nutzung abgebrannt wurden, kann so die noch vorhandene Masse des Brandlehms ermittelt werden, die neben der Grundfläche ein wichtiger Parameter zur Einschätzung der ehemaligen Größe und Bauart des Hauses ist. Erste Anwendungen auf Häusergruppen der chalkolitischen Siedlung Maidanetske (Ukraine) hatten in einer früheren Studie

gezeigt, dass die Zahlenwerte der Grundflächen, Brandlehm Massen und Flächendichten sich in Diagrammen zu markanten Clustern gruppieren. Daran anknüpfend, untersucht die vorliegende Studie, ob die durch die Magnetik ermittelten Brandlehm Massen und die Systematiken, die sich in den Punktwolken der Diagramme andeuten, rechnerisch nachvollzogen werden können, wenn man einfache Modelle des Lehmbedarfs beim Hausbau zugrunde legt. Es stellt sich heraus, dass dies der Fall ist, vorausgesetzt, dass eine plausible Abschätzung des Verlustes von Brandlehm durch Erosion, Verschleppung und unvollständige Funderfassung möglich ist. Im betrachteten Fall ist dies durch Einführung einer linearen Flächenfunktion möglich. Die Diskussion der Unsicherheiten der magnetischen Inversionsmethodik zeigt, dass für zukünftige Untersuchungen eine breitere Felddatenbasis in Form gezielter Bohrungen bzw. Grabungen wünschenswert ist sowie eine erweiterte geologische und geophysikalische Probenanalytik, die die Randbedingungen der Auswertung absichert.

Abstract

The magnetic mapping of prehistoric settlements can contribute to investigations of the social structures of past societies if the architecture, size, frequency and arrangement of the buildings can be determined with sufficient accuracy from the measurements. In contrast to excavations and drillings, which always have the character of random sampling, geophysical measurements enable us to record settlement areas completely, so that statistical analyses can be based on considerably larger populations. Against this background, evaluation methods have been developed in recent years that make

it possible to determine the masses of magnetised material still present in the ground. For Stone Age buildings constructed from wood, wickerwork and clay, which are burnt down after use, the remaining mass of burnt clay can thus be determined, which, in addition to the floor area, is an important parameter for estimations of the former size and type of construction of the houses. First applications to groups of houses of the Chalkolithic settlement of Maidanetske (Ukraine) had shown in an earlier study that the numerical values of the base areas, daub masses and daub surface densities grouped

together in diagrams to form distinctive clusters. Following from this, the present study investigates whether the daub masses determined by magnetics and the systematics indicated in the point clouds of the diagrams can be reproduced mathematically if simple models of the clay requirements for house construction are used as a basis. It turns out that this is indeed the case, provided that a plausible estimation of the loss of daub due to erosion, dispersion and incomplete sample recording is

possible. In the case under consideration, this is feasible by introducing a linear area function. The discussion of the uncertainties of the magnetic inversion method shows that a broader field database in the form of targeted drillings or excavations is desirable for future investigations, as well as an extended geological and geophysical sample analysis that secures the boundary conditions of the evaluation.

EINLEITUNG

„Gespensterjäger auf eisiger Spur“ ist der erste Band einer Buchreihe, die bei unseren Kindern sehr beliebt war. Darin setzen ein etwas ungeschickter Knabe, eine gespensterjagdversierte Seniorin und ein kollaborierendes Gespenst dessen böartigen Kollegen derart zu, dass sie eingeht und in die gesellschaftliche Harmlosigkeit transformiert werden. Und nun steht da ein archäologisch-soziologisches Schreckgespenst aus der Steinzeit im Raum: *A haunting spectre — archaeological studies of social organisation, economic practice and inequality?*

Geophysiker:innen, die archäologische Stätten prospektieren, sind meistens begeistert, ihre magnetischen oder elektrischen oder seismischen Messdaten in die Konturen der im Untergrund verborgenen Reste von Bauten und Siedlungen zu transformieren. Erdverbunden-physikalisch wie sie sind, finden sie jedoch die Deutung der Messdaten um so heikler, je weiter sie sich von der Materialität der Funde und Befunde entfernt. Und die Projektion ihrer substanziellen Ergebnisse in den Ideenkosmos steinzeitlicher Gesellschaftsformen erscheint vielen nebulös — ein akademisches Nachtgespenst.

Können wir vielleicht Stege bauen, über die man sich vom sicheren Ufer der Messdaten aus etwas in den Nebel vortasten kann, der den Blick auf steinzeitliche Gesellschaften verdeckt? Mit geophysikalischen Daten kann man zu den Disputen über Zustände und Wandlungen alter Gesellschaften etwas beitragen, wenn man ein plausibles Konzept hat, wie diese sich in den Inventaren der geophysikalisch fassbaren Siedlungsreste widerspiegeln könnten. Dann kann alles zu möglichen sozialen Indikatoren werden, was sich geophysikalisch quantifizieren lässt: Hausgrößen, Grundrisstypen, Raumaufteilungen, Scherben, Müll und manches mehr.

Ein denkbare Konzept in dieser Richtung ist die Nutzung von Verteilungsfunktionen von materiellem Besitz oder Geldvermögen, aus denen sich sozio-ökonomische Indizes bestimmen lassen, die (hoffentlich) etwas über den Zustand einer Gesellschaft aussagen. Ein einfaches Beispiel dafür ist der Gini-Koeffizient,

der die Ungleichverteilung der Einkommen oder Besitztümer von Personen oder Haushalten in einer Gesellschaft in einer Maßzahl zusammenfasst, mit deren Hilfe dann verschiedene Gesellschaften miteinander verglichen werden können (u. a. Hofmann *et al.* 2024).

Will man dieses Konzept auf vorgeschichtliche Gesellschaften anwenden, müssen zwei Bedingungen erfüllt sein: Es müssen Arten von materiellen Resten identifiziert werden, die als Anzeichen des Wohlstands oder der gesellschaftlichen Stellung ihrer früheren Besitzer angesehen werden können, und diese Reste müssen möglichst vollständig, oder zumindest in einem statistisch repräsentativen Umfang, auch aufgefunden und quantifiziert werden.

Ein willkommenes Opfer für diesen Ansatz sind die neolithischen Siedlungen Südosteuropas, besonders der Tripolje-Kultur, deren Siedlungen aus bis zu mehreren tausend Häusern bestanden (u. a. Müller *et al.* 2016; Ohlrau 2020; Hofmann *et al.* 2024). Die Bewohner bauten ihre Häuser aus Baumstämmen und Flechtwerk und verwendeten Lehm für die Fußböden und das Verputzen der Wände (u. a. Burdo *et al.* 2013). Da sie die Angewohnheit hatten, ihre Häuser niederzubrennen, wenn sie ihrer überdrüssig geworden waren, und weil die abgebrannten Häuser auch nicht überbaut wurden, können wir die Siedlungen heute vollständig mit magnetischen Flächenmessungen erfassen. Denn der gebrannte Lehm (*burned daub*) ist hochmagnetisch und hinterlässt in den Karten der magnetischen Feldstärke an den Orten der verbrannten Gebäude Muster, magnetische Anomalien, die sich deutlich vom Hintergrund der ungebrannten Böden abheben. Was liegt also näher, als die Größe der Häuser für den Wohlstand oder die gesellschaftliche Stellung ihrer Bewohner zu nehmen? Aus magnetischen Flächendaten wären die Hausgrößen für die gesamte Siedlung zu bestimmen. Auf diese Weise wäre auch das Kriterium der Vollständigkeit erfüllbar, selbst wenn nur wenige Häuser tatsächlich ausgegraben werden.

Aber ist die Größe der Grundfläche eines Gebäudes, wie sie sich aus der magnetischen Karte ablesen lässt, wirklich ein Maß für seine tatsächliche „Größe“

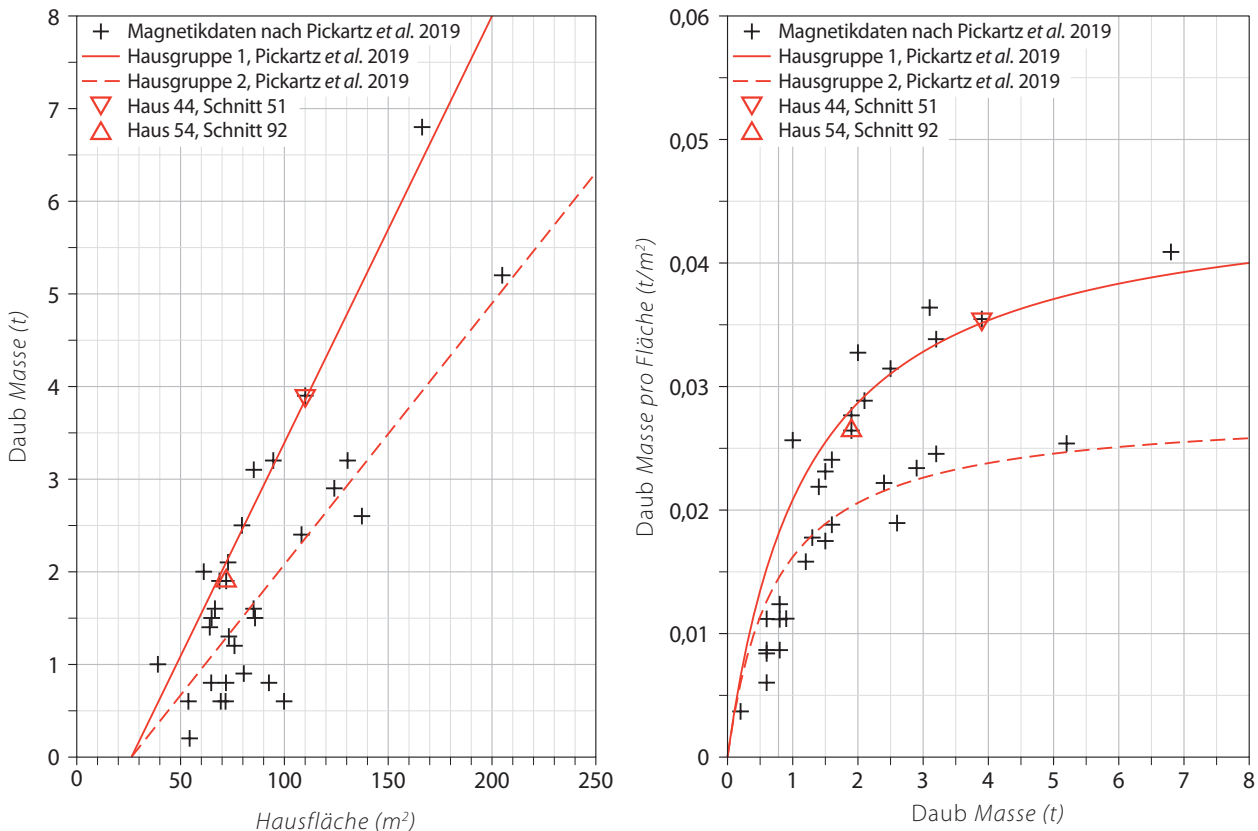


Abb. 1. Aus Magnetik-Messungen bestimmte Grundflächen, Daub-Massen und Daub-Flächendichten von ausgewählten Tripolje-Häusern aus der chalkolithischen Siedlung Maidanetske (Ukraine). **Kreuze:** aus der Magnetik bestimmte Werte; **rote Dreiecke:** aus Grabungen bestimmte Kalibrationspunkte; **rote Linien:** Ausgleichskurven für zwei Punktcluster (Daten und Ausgleichskurven nach Pickartz et al. 2019).

und den Wohlstand der Bewohner? Sicher nicht, wenn man Mietskasernen mit Villen vergleicht. Auch der Stadtplan von Manhattan könnte Zweifel wecken; Wolkenkratzer sind bei gleichen Grundflächen sehr unterschiedlich hoch und bedeutsam. Nach den bisherigen Erkenntnissen scheint die Mehrheit der Tripolje-Häuser jedoch von ähnlicher Bauart zu sein. Daher erscheint auch der Quantisierungsansatz für Gleichheit oder Ungleichheit über Hausgrößen plausibel, zumindest wenn auch die Höhe der Bauten, sprich: ob sie ein oder doppelstöckig waren, in irgendeiner Form aus den magnetischen Messungen abgeschätzt werden kann.

Den Ausgangspunkt der vorliegenden Studie bildet die Arbeit von Natalie Pickartz et al. (2019), in der es unserem Autorenteam gelang, aus magnetischen Messungen die Massen des Brandlehms zu bestimmen, der von Gebäuden der chalkolithischen Tripolje-Siedlung Maidanetske (Ukraine) im Boden noch vorhanden sein muss.

Trägt man die ermittelten Daub-Massen der Häuser gegen ihre Grundflächen auf (Abb. 1 links), so ordnen sich die Datenpunkte in einer Fläche an, die recht

scharf durch zwei Geraden begrenzt werden (rote Linien in Abb. 1). Es scheint sogar eine gewisse Häufung der Punkte entlang dieser Geraden zu geben. Das heißt, die ermittelten Daub-Massen, die aus dem Lehm des Wandputzes und der Fußböden gebrannt wurden, gehen ungefähr linear mit der Grundfläche, was plausibel ist.

Trägt man über den magnetisch ermittelten Daub-Massen der Häuser die Daub-Massen pro m² Grundfläche auf (Abb. 1 rechts), also eine Art „spezifischer Daub-Masse“, dann fallen die Punkte in eine Fläche, die von zwei konkav gekrümmten Funktionen begrenzt wird, entlang derer sich wie zuvor die Punkte häufen. Offenbar wird für kleinere Häuser nicht nur weniger Daub gefunden als für große, was plausibel ist, sondern überhaupt auch weniger Daub pro Flächeneinheit, was nicht unmittelbar einleuchtet.

Sollen diese Informationen in soziale Indikatoren irgendeiner Art umgemünzt werden, stellt sich zuvor die ganz elementare Frage, wie genau die ermittelten Werte der Massen überhaupt der ursprünglichen Größe der Häuser entsprechen. Genau darauf zielt die vorliegende Studie. Konkret wird der Frage nachgegangen, ob die

aus der Magnetik bestimmten Werte der Massen und die Form der Kurven rechnerisch nachvollzogen werden können, wenn man Modelle der Lehmengen, die für den Hausbau benötigt wurden, zugrunde legt. Dies zu beantworten ist das Ziel dieses Aufsatzes.

THE HAUNTING SPECTRE GO GEOPHYSIC

Seit vielen Jahren werden geophysikalische Kartierungen unterschiedlicher Art dafür genutzt, archäologische Stätten zu vermessen. Komplette Stadtpläne antiker Städte konnten auf diese Art rekonstruiert werden. Von den verschiedenen geophysikalischen Messmethoden haben sich engmaschige bodennahe Kartierungen des Magnetfeldes als Standard etabliert, dies wegen zahlreicher Erfolge, aber auch wegen der einfachen und effizienten Durchführbarkeit der Feldmessungen.

Die archäologische Auswertung magnetischer Messdaten ist nur scheinbar einfach. Zwar lassen sich auf den Magnetik-Karten die Konturen von Gebäuderesten und anderen archäologischen Strukturen, die oberflächennah im Untergrund verborgen sind, leicht identifizieren — vorausgesetzt sie bestehen aus genügend stark magnetisiertem Material. Quantitative Aussagen über die entdeckten Objekte, in unserem Fall Grundflächen und Massen von Gebäuderesten, lassen sich jedoch nur selten mit befriedigender Genauigkeit unmittelbar aus den Messdaten ablesen.

Dieses hat mehrere Gründe: Die Magnetfelder magnetisierter Körper, die gemessenen „Anomalien“, bestehen immer aus positiven und negativen Anteilen, die stets in den Magnetik-Karten sichtbar sind (außer in einigen speziellen Fällen). Lage und Kontur des magnetisierten Körpers können nicht exakt mit der Kontur des positiven oder negativen Anomalie-Teils identifiziert werden, da deren Form und Proportionen von der unbekannten Form, Tiefenlage, Orientierung und Magnetisierung des Körpers im Boden abhängen. So wird eine magnetische Anomalie umso breiter, je tiefer der magnetisierte Körper im Boden liegt, genauer: je tiefer

Bevor die Ergebnisse der Rechnungen und Überlegungen präsentiert werden, folgen zunächst wenige Sätze zur Methodik und zum Modell des Lehmengenbedarfs für den Tripolje-Hausbau.

der magnetisierte Körper unter dem Niveau der Sensoren während der Vermessung lag.

Der Fortschritt der Methodik in der Arbeit von Natalie Pickartz *et al.* (2019), auf die hier Bezug genommen wird, besteht darin, dass durch eine Inversionsrechnung die Karte der ca. 30 cm oberhalb der Erdoberfläche gemessenen Magnetfeldanomalien in eine Karte der Magnetisierung des Bodens im Tiefenniveau der Brandlehmschicht umgerechnet wird. Dafür muss die Tiefe der *Daub*-Schicht aus Bohrungen oder Grabungen bekannt sein.

Geht man in erster Näherung davon aus, dass der Brandlehm gleichförmig magnetisiert wurde, lässt sich aus den berechneten Magnetisierungswerten die Masse des Brandlehms abschätzen, der die Anomalie erzeugt. Zur Umrechnung der Magnetisierung des *Daub* in seine Dichte benötigt man eine Kalibrierfunktion. Sie wurde bei Natalie Pickartz *et al.* (2019) durch den Vergleich der *Daub*-Massen, die in drei Ausgrabungen gefunden wurden, mit den für die Grabungsflächen zuvor bestimmten Magnetisierungswerten durch eine Regressionsrechnung empirisch bestimmt.

Das Ergebnis der Anwendung dieser Methodik sind die Diagramme in Abb. 1, die schon in der Einleitung als Aufhänger dienten. Sie zeigen die linearen und nicht-linearen Relationen, die für die Grundflächen, *Daub*-Massen und die Flächendichten des *Daub* für eine Gruppe von 31 abgebrannten Tripolje-Häusern¹ aus Maidanetske gefunden wurden. Frage nunmehr: Lassen sich diese Relationen zumindest näherungsweise unter einfachen Annahmen verifizieren?

NUMERISCHER HAUSBAU

Um Vergleichswerte für die magnetisch bestimmten Brandlehmengen und Flächendichten zu ermitteln, kann man versuchsweise die Lehmengen abschätzen,

die beim Hausbau benötigt wurden. Diese Lehm volumina entsprächen den maximal zu erwartenden *Daub*-Volumina, wenn sämtlicher Lehm gebrannt wurde und

1 In der Studie von Natalie Pickartz *et al.* (2019) wurden Reste von 44 Bauwerken untersucht, von denen jedoch die nicht gebrannten Gebäude und die sog. Megastrukturen, insgesamt 13 Bauten, von der vorliegenden Studie

ausgenommen wurden, da die nicht-gebrannten systematisch schwächer magnetisiert sind und die Megastrukturen von der Bauform stark von den hier betrachteten Bauten abweichen.

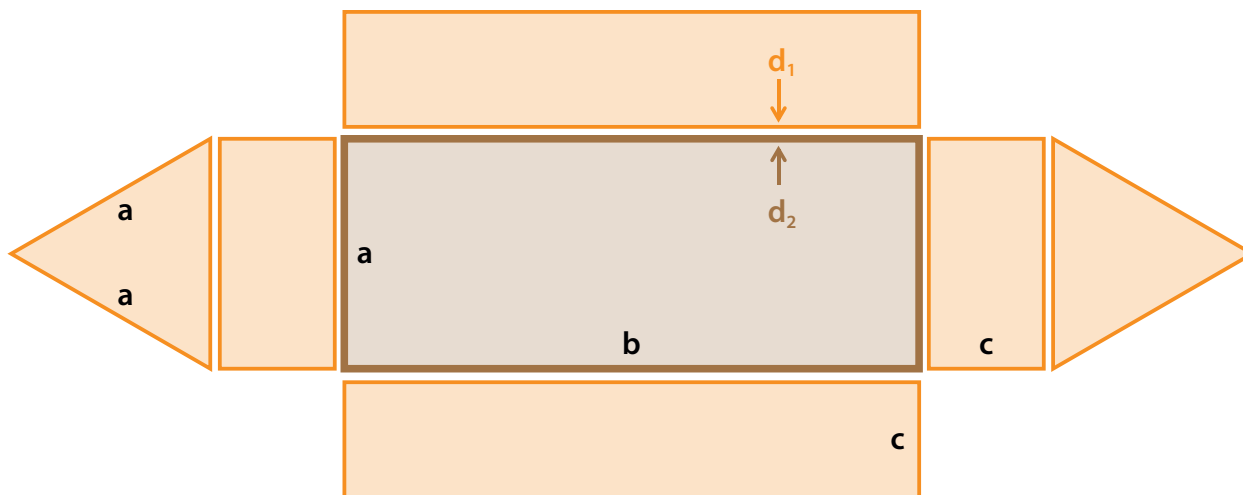


Abb. 2. Modell der mit Lehm belegten Flächen eines typischen Tripolje-Hauses; **a** Länge; **b** Breite; **c** Höhe des Erdgeschosses; **d1** Dicke des Fußbodens; **d2** Dicke des Wandputzes. Die Giebelflächen sind als gleichseitige Dreiecke ausgelegt.

beim Brand keine bedeutende Schrumpfung eintrat. Die Volumina müssen dann nur noch mit einer repräsentativen *Daub*-Dichte multipliziert werden, um auf die Vergleichsmassen zu kommen.

Da es bei der Berechnung primär um das Volumen des Lehms geht, der für Fußböden und Wandputz beim Bau der Tripolje-Häuser benötigt wurde, gestaltet sich die Modellrechnung als mathematische Hausaufgabe für die gymnasiale Mittelstufe:

Gesucht werden die Volumina der dünnen quaderförmigen Lehmplatten des Fußbodens und der vier Seitenwände sowie zweier dünner Prismenscheiben von dreieckiger Grundfläche,² die für die Giebel stehen (Abb. 2). Für die Berechnung der *Daub*-Massen bilde die Summe der Teilvolumina und multipliziere mit der Dichte des *Daubs* [... einfach genug...]. In Anlehnung an die Ergebnisse von Ausgrabungen und Prospektionen verwende die folgenden Zahlenwerte: Fußbodendicken zwischen 2 und 8 cm, Wandputz zwischen 0,5 und 2,0 cm, Seitenverhältnisse der Hausgrundflächen zwischen 1,5 und 4,0. Für die Giebel verwende gleichseitige Dreiecke. *Daub*-Dichten mögen zwischen 1200 und 2000 kg/m³ variieren.

Durch die Breite der Wertebereiche der geometrischen Variablen und der Dichte können die Ergebnisse etwas unübersichtlich werden, wenn man bei der Modellbildung alle möglichen Wertekombinationen

berücksichtigt. Daher werden im Folgenden nur Minimum-, Maximum- und mittlere Modelle gebildet. Die Werte der Modellvariablen, die den Diagrammen zugrunde liegen, sind in Tabelle 1 aufgelistet. Die angenommenen Dicken des Lehmputzes und der Lehmfußböden orientieren sich an den Dicken der *Daub*-Fundstücke, die in Grabungen gefunden wurden, die Hausdimensionen an den Magnetik-Karten und die Dichtewerte an Labormessungen von *Daub*-Fundstücken (Burdo *et al.* 2013; Müller *et al.* 2017; Ohlrau 2020; Wunderlich *et al.* 2021).

Das Ergebnis der Berechnung zeigt Abb. 3. Es ist ein Desaster: Die Modellkurven (blau) plotten weit oberhalb der aus der Magnetik ermittelten Werte (Kreuze) und Kurven (rot) der Massen-Flächen- und Flächendichte-Massen-Relationen. Das heißt, die theoretischen und empirischen Werte weichen um viele Tonnen voneinander ab. Selbst das Modell mit der dürrtigiten Lehmausstattung (A1, blau gepunktet) ist weit von dem entfernt, was gefunden wurde, und fast noch schlimmer: auch die Typen der Flächendichtekurven (Abb. 3 re.) sind verschieden, die Krümmungen entgegengesetzt. Die theoretischen Kurven sind konvex, die empirischen konkav! Interpretativ ein Alptraum, Gespensterstunde ...

2 Das Hausdesign mit dreieckigem Giebel orientiert sich an Nachbauten von Tripolje-Häusern (Burdo *et al.* 2013, Gheoghiu 2016). Es gibt jedoch Funde von Tonmodellen, die die Häuser mit halbrunden Giebeln darstellen

(Burdo *et al.* 2013). Für die hier durchgeführten Berechnungen sind die Unterschiede der Giebelform nicht bedeutend, da die Flächengrößen sich nur geringfügig unterscheiden.

Tabelle 1. Parameter der Modelle, die den Modellkurven in Abb. 3, 5, 6 und 7 zu Grunde liegen. Die geometrischen Variablen sind in Abb. 2 erläutert.

Modell-Nr.	Dicke des Fußboden-Lehms d1 (cm)	Dicke des Lehmputzes d2 (cm)	Daub-Dichte (g/cm ³)	Hausbreite a (m)	Hauslänge b (m)	Wandhöhe c (m)	Giebelhöhe (m)	Kommentar	Abb. Nr.
A1	4	1,0	1,5	0–10	2,5 a	2,5	0,866 a		3 + 5
A2	5	1,5	1,5	0–10	2,5 a	2,5	0,866 a		3 + 5
A3	6	2,0	1,5	0–10	2,5 a	2,5	0,866 a	= B3	3 + 5
A4	8	3,0	1,5	0–10	2,5 a	2,5	0,866 a		3 + 5
B1	6	2,0	1,2	0–10	2,5 a	2,5	0,866 a		6
B2	6	2,0	1,3	0–10	2,5 a	2,5	0,866 a		6
B3	6	2,0	1,5	0–10	2,5 a	2,5	0,866 a	= A3	6
B4	6	2,0	2,0	0–10	2,5 a	2,5	0,866 a		6
C1	4	0,0	1,5	0–10	2,5 a	2,5	0,866 a		7
C2	5	0,0	1,5	0–10	2,5 a	2,5	0,866 a		7
C3	6	0,0	1,5	0–10	2,5 a	2,5	0,866 a		7
C4	8	0,0	1,5	0–10	2,5 a	2,5	0,866 a		7
C5	10	0,0	1,5	0–10	2,5 a	2,5	0,866 a	= Gruppe 1 aus Abb. 3	7
C6	12	0,0	1,5	0–10	2,5 a	2,5	0,866 a	= Gruppe 2 aus Abb. 3	7

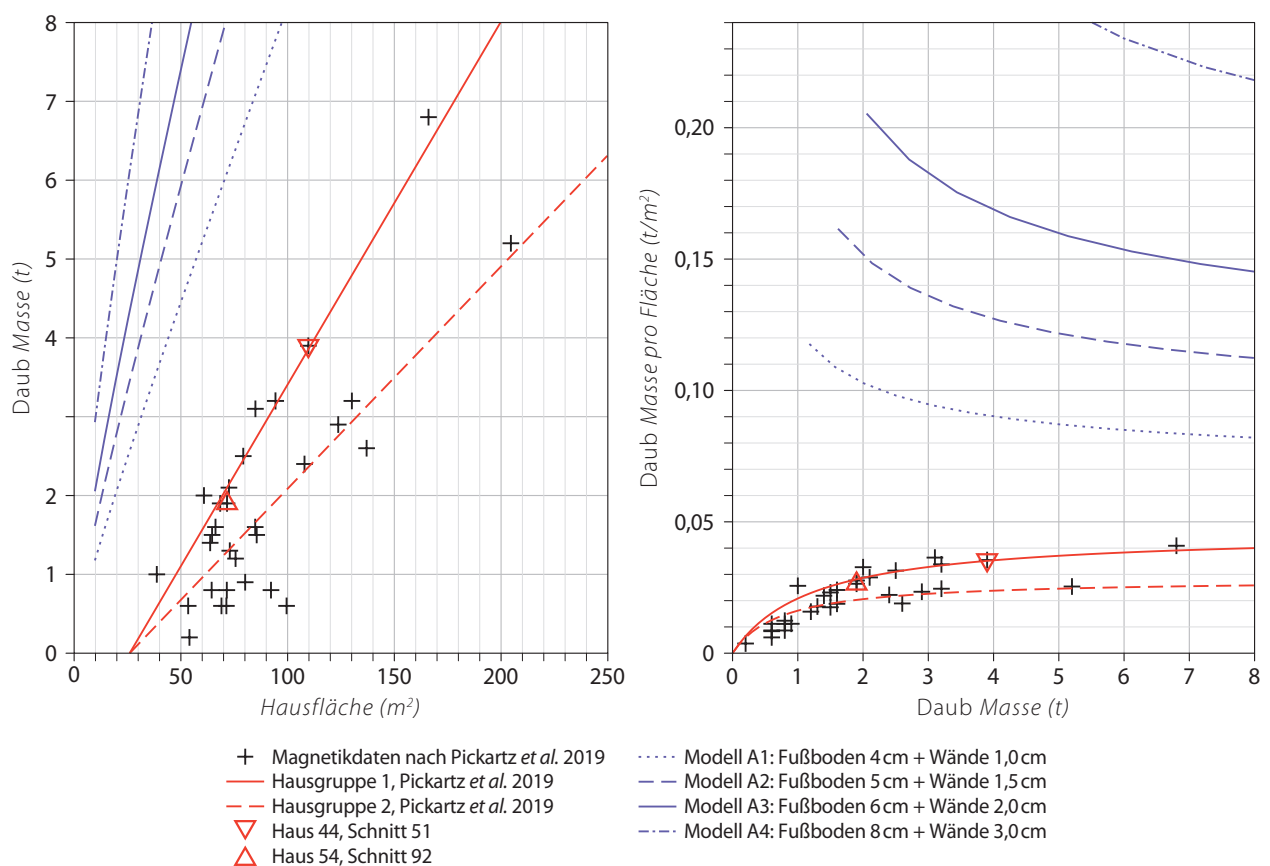


Abb. 3. Grundflächen, Daub-Massen und Daub-Flächendichten von Tripolje-Häusern. Felddaten (identisch mit Abb. 1): **Kreuze**: aus der Magnetik bestimmte Werte; **rote Dreiecke**: aus Grabungen bestimmte Kalibrationspunkte; **rote Linien**: Ausgleichskurven für zwei Punktcluster (Daten und Ausgleichskurven aus Pickartz et al. 2019); **blaue Kurven**: modellierte Daten für eine Modellfamilie, bei der die Dicken der Lehmschichten von Wandputz und Fußboden variiert wurden; Modellparameter siehe Legende, Tabelle 1 und Abb. 2.

DER ZAHN DER ZEIT

Wie kann man die Diskrepanz zwischen den theoretisch berechneten und den magnetisch gefundenen Massen erklären? Die Zerstörung der Häuser liegt mehr als 5500 Jahre zurück, viel Zeit, in der Überreste abgeräumt, zerkleinert, über das Land verteilt und erodiert wurden, all dies Prozesse, die schwer zu fassen sind, aber noch in irgendeiner Form in das numerische Modell eingefügt werden müssen, wenn Daten und Modelle zueinander finden sollen.

Wie genau sind die Daten der Magnetik und der Grabungen? Magnetik und Funddaten sind miteinander konsistent, denn die magnetischen Inversionsrechnungen wurden mit den ergrabenen *Daub*-Massen kalibriert. Die *Daub*-Massen wurden jedoch nur ab einer

gewissen Fundstückgröße erfasst. Bei der Zerkleinerung der Brandlehmbrocken entstehen Krümel bis hin zu feinen Korngrößen, vermutlich mit fraktaler Größenverteilung. Es ist daher wahrscheinlich, dass ein großer Teil des zerfallenen Brandlehms noch im Boden steckt, aber mit den angewendeten Mitteln nicht erfasst wurde. Entsprechend fehlt dieser Anteil auch bei der Kalibration der Magnetik.

Während sich die Menge der in der Massensumme fehlenden kleinen *Daub*-Partikel zumindest theoretisch durch Probenanalysen ergänzen ließe, erscheint es hoffnungslos, ad hoc plausible Annahmen über erodierte oder durch Pflügen vom Platz geräumte Mengen Annahmen zu machen.

EINE SPUR DER VERSCHWUNDENEN MASSEN

Glücklicherweise lässt sich ein Ansatzpunkt zur Lösung des Problems der fehlenden Massen in den Magnetik-Daten und den Kalibrierpunkten selbst finden.

An dem Fläche-Masse-Diagramm der magnetisch vermessenen und modellierten Häuser (Abb. 3, li.) fällt auf, dass die Punkte der vermessenen Häuser (Kreuzchen) systematisch nach rechts verschoben sind. Denn die Punktfolgen sollten eigentlich zum Ursprung des Koordinatensystems hin konvergieren, weil ein Haus der Fläche Null auch eine Masse Null haben würde. Für die Modellkurven (blau) trifft dies auch zu. Die Feldatenpunkte reihen sich jedoch entlang der beiden Regressionslinien (rot) auf, die bereits für ein 30 m²-Haus die Masse Null anzeigen. Dies ist kein Fehler der Magnetik-Daten, denn auch die Datenpunkte der beiden ausgegrabenen Gebäude 44 und 54 (rote Dreiecke), die direkt auf den Funden beruhen, reihen sich auf die linken Regressionsgeraden ein. Das heißt, es fehlen bereits *Daub*-Massen bei der Kalibrierung — und zwar aus den oben genannten Gründen: Erosion, Verschleppung und unvollständige Funderfassung.

Nehmen wir an, dass Haus 44 und 54 in gleicher Weise von dem teils realen, teils scheinbaren *Daub*-Schwund betroffen sind, dann können wir einen ersten Hinweis auf die fehlende Menge bekommen, indem wir die Ausgleichsgerade, auf der die Punkte der Häuser 44 und 54 liegen (rot durchgezogen), nach unten verlängern, bis sie bei Fläche Null auf die Massen-Achse stößt. Dies ist bei ca. -2t der Fall. Das heißt, es müssen 2t zu den aus der Magnetik abgeleiteten Massen-Werten addiert werden, damit die Ausgleichsgeraden, sinnvollerweise, durch den Ursprung des Koordinatensystems gehen.

Nun ist jedoch nicht einzusehen, warum bei allen vermessenen Gebäuden ausgerechnet 2t *Daub* fehlen

sollten, und dies unabhängig von der Grundfläche. Der Verlust wird sicher auch einen Anteil enthalten, der ungefähr proportional zur Grundfläche ist, also einen Faktor, der den Verlust pro Flächeneinheit in t/m² angibt. Um dafür einen Zahlenwert zu bestimmen, kann man die Modellrechnungen zu Hilfe nehmen. Für ein 30 m²-Haus ergibt die unkorrigierte Regressionsgerade eine Masse von 0t, nach den Modellrechnungen sollte der Wert aber zwischen 3 und 5t liegen. Nehmen wir als mittleren Wert 4t, dann können wir aus den beiden Zahlenwerten eine Geradengleichung aufstellen, die eine plausible Schätzung der verschwundenen Massen M_V in Abhängigkeit von der Hausfläche F ermöglicht. Sie lautet

$$(1) \quad M_V \approx m_0 + m_F \cdot F$$

wobei sich, wie oben erläutert, für den konstanten Term $m_0 = 2t$ und für den Flächen-Koeffizienten $m_F = 1/15 t/m^2$ (entsprechend M_V in t, F in m²) ergibt.

Die Gleichung wird angewendet, indem die M_V -Werte, die sich für die Grundflächen F der vermessenen Häuser ergeben, auf die magnetisch bestimmten Massen aufaddiert werden. Dies ergibt das Diagramm in Abb. 4, das eine um den geschätzten *Daub*-Schwund korrigierte Version des Diagramms in Abb. 1 darstellt.

An dieser Stelle muss noch eine Flächenkorrektur erwähnt werden, die bei der Berechnung der Koeffizienten der Korrekturgleichung und in Abb. 4 bereits stillschweigend eingeflossen ist und die auch für die Abb. 5–7 angewendet wurde. Sie besteht darin, dass die in Natalie Pickartz *et al.* (2019) tabellierten Grundflächendaten für die vorliegende Studie um 25% nach unten korrigiert wurden. Dieser Wert ergab sich durch den Vergleich der für die Gebäude 44 und 54 tabellierten Werte mit Grabungsplänen und Fotos (Müller *et al.* 2017; Ohlrau 2020).

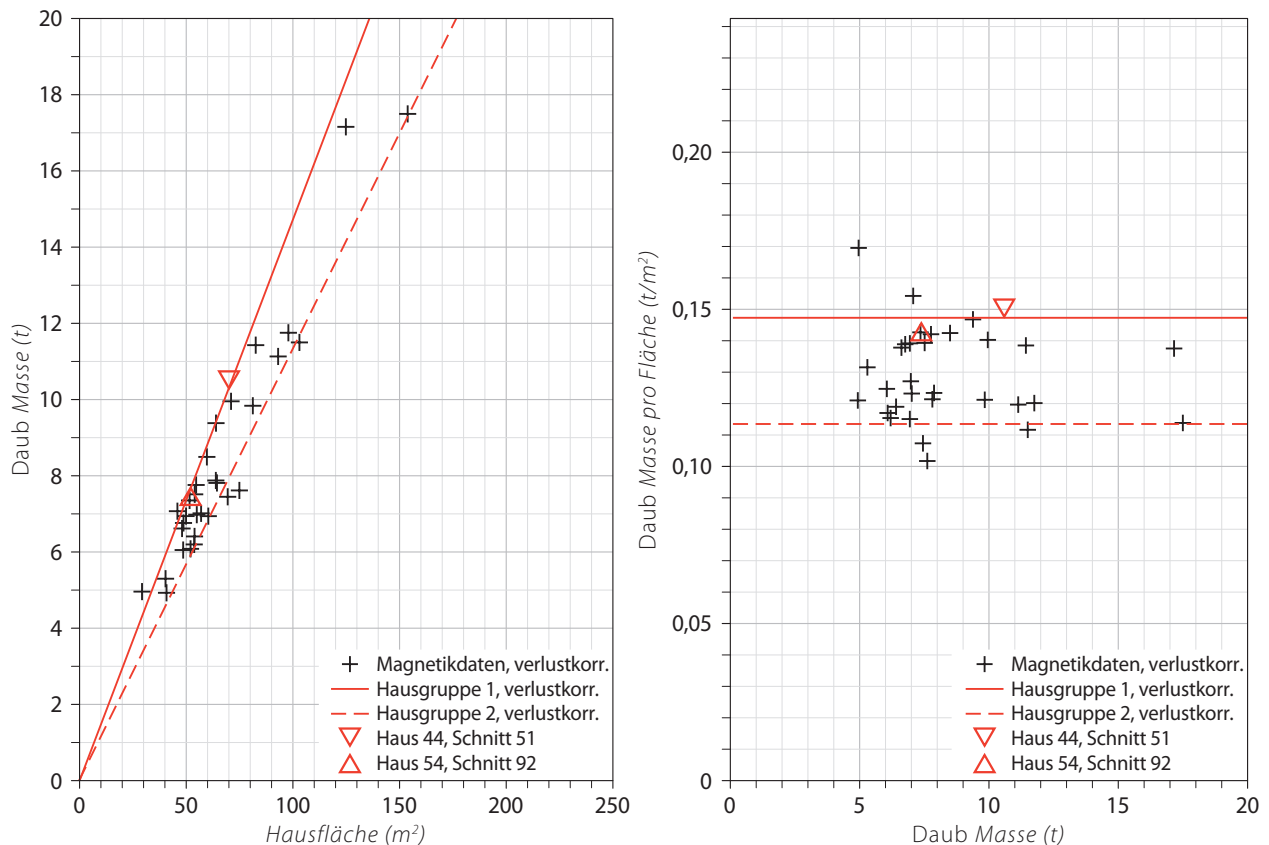


Abb. 4. Aus Magnetik-Messungen bestimmte Grundflächen, Daub-Massen und Daub-Flächendichten von ausgewählten Tripolje-Häusern aus der chalkolithischen Siedlung Maidanetske (Ukraine) nach Anwendung der Massenschwund-Korrektur nach Gleichung (1). Kreuze: aus der Magnetik bestimmte Werte; rote Dreiecke: aus Grabungen bestimmte Kalibrationspunkte; rote Linien: Ausgleichskurven für zwei Punktcluster. Daten vor der Schwund-Korrektur siehe Abb. 1.

AUFTRITT DER MASSEN

Wie wirken sich die geschilderten Maßnahmen auf den Vergleich der magnetisch und per Modellierung bestimmten Daten aus? Zur Beantwortung dieser Frage sind die jetzt schwund- und flächenkorrigierten Datenpunkte zusammen mit theoretischen Kurven, die sich für unterschiedliche Modellfamilien ergeben, in den Abb. 5–7 dargestellt.

In der ersten Modellfamilie (Abb. 5) wurden die Dicken des Lehmputzes (1–3 cm) und der Lehmfußböden (4–8 cm) variiert, die Daub-Dichte jedoch konstant gehalten ($1,5 \text{ g/cm}^3$). Das Ergebnis ist höchst erfreulich: Die korrigierten Messpunkte reihen sich widerspruchsfrei entlang der Modellkurven auf. Sogar die konvexen Krümmungen im Flächendichte-Massen-Diagramm werden von den beiden Hauptclustern der Punktwolke nachvollzogen (Abb. 5 re.). Die Magnetik-Werte sind kompatibel mit der Annahme, dass der Wandputz im Mittel 1,5–2,0 cm und der Lehmfußboden 5–6 cm dick war. Diese Werte passen recht gut zu den Vorstellungen, die man sich auf Grund der Fundstücke bilden kann.

Diese Modellwerte sind jedoch nicht eindeutig bestimmt. Bei der zweiten Modellfamilie (Abb. 6) wurden die Lehmdicken konstant gehalten (entsprechend dem Modell A3 aus Abb. 5), und die Dichte wurde zwischen 1,2 und $2,0 \text{ g/cm}^3$ variiert. Es zeigt sich, dass Anpassung für Dichtewerte zwischen 1,3 und $1,5 \text{ g/cm}^3$ ähnlich gut ist wie zuvor. Auch höhere Dichtewerte würden zum Erfolg führen, aber dann müsste man die Wandputz- und Fußbodendicken entsprechend verringern.

Zum Schluss folgt eine Modellfamilie, die auf der Vorstellung beruht, dass der Wandputz-Daub im Laufe der Zeit weitestgehend abgeräumt und dispergiert oder erodiert wurde, so dass die im Boden verbliebenen Reste hauptsächlich aus Fußboden-Daub bestehen. Bei den entsprechenden Modellkurven (Abb. 7) wurden die Wände daher weggelassen. Die Fußbodendicken wurden zwischen 4 und 12 cm variiert, die Dichte bei $1,5 \text{ g/cm}^3$ konstant gelassen. Die Modellkurven sind wie zuvor in blau dargestellt, zum Vergleich sind die Regressionsgeraden der schwund-korrigierten Daten aus Abb. 4 mit eingetragen. Die Diagramme zeigen, dass auch die

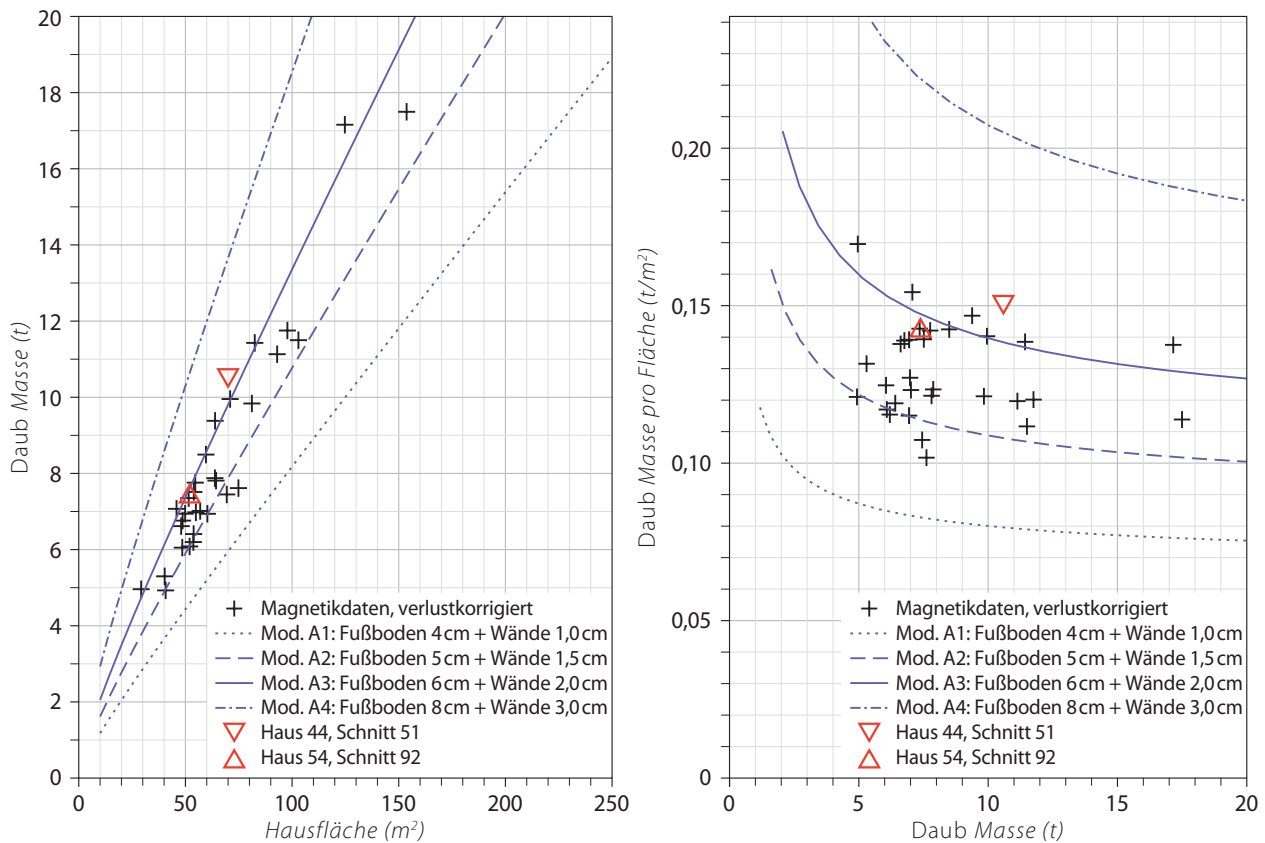


Abb. 5. Grundflächen, Daub-Massen und Daub-Flächendichten von Tripolje-Häusern. Felddaten nach Anwendung der Massenschwund-Korrektur nach Gleichung (1; identisch mit Abb. 4): **Kreuze**: aus der Magnetik bestimmte Werte; **rote Dreiecke**: aus Grabungen bestimmte Kalibrationspunkte, **blaue Kurven**: modellierte Daten für eine Modellfamilie, bei der die Dicken der Lehmsschichten von Wandputz und Fußboden variiert wurden; Modellparameter siehe Legende, Tabelle 1 und Abb. 2.

Fußböden allein in der Lage sind, die magnetisch ermittelten Werte zu erklären. Zwar liegen die blauen Geraden in Abb. 7 überwiegend etwas unterhalb der Messpunkte, die Modellkurven könnten jedoch leicht durch die Wahl einer etwas höheren Dichte dorthin angehoben werden. Auffällig ist vor allem eines: die konvexe Krümmung der Flächendichte-Massen-Kurven

(Abb. 7 rechts) verschwindet durch das Weglassen der Wände. Die Kurvenverläufe passen schlechter zu den Punktklustern als bei den vorigen Modellfamilien. Man könnte dies für einen Hinweis ansehen, dass bei den vermessenen Häusern noch Wandreste im Boden sind, auch wenn statistische Tests den 3 Modellfamilien sicher ähnliche Fitqualitäten attestieren würden.

SCHWINDET DER SCHWUND?

Die anfangs festgestellte Diskrepanz zwischen den Daub-Massen aus der Magnetik und aus den Hausmodellen (Abb. 1) kann also offenbar durch die Berücksichtigung von Schwund-Massen, die einer linearen Flächenfunktion folgen, ausgeglichen werden (Abb. 5–7). Die Werte der Schwund-Funktion können wahlweise auf die Felddaten aufaddiert (so geschehen hier) oder von den Modelldaten subtrahiert werden. Der Flächendichte-Koeffizient m_F der Funktion ist jedoch ohne weitere Annahmen nicht eindeutig festgelegt. Im präsentierten Fall wurde m_F so bestimmt (hier

$1/15 \text{ t/m}^2$), dass eine Übereinstimmung mit Hausmodellen erreicht wurde, derer Wandputz- und Fußboden-Stärken (ca. 2 bzw. 6 cm) den Werten ähneln, die an Fundstücken festgestellt wurden. Würde man anhand von Ausgrabungen zu dem Schluss kommen, dass die originalen Putz- und Fußboden-Stärken geringer oder größer als die hier angenommenen Werte sind, müsste der Koeffizient angepasst werden, und die Schwund-Funktion würde auch dann einen akzeptablen Fit produzieren.

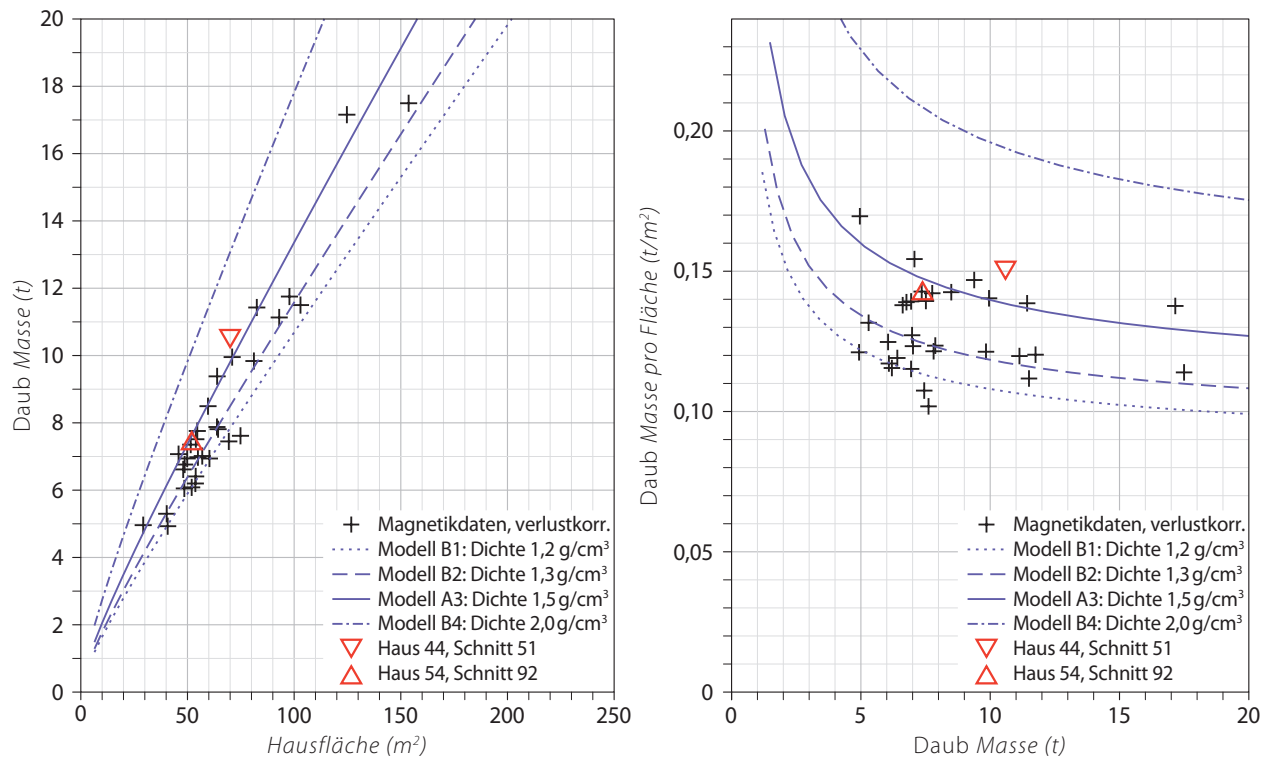


Abb. 6. Grundflächen, Daub-Massen und Daub-Flächendichten von Tripolje-Häusern. Felddaten nach Anwendung der Massenschwund-Korrektur nach Gleichung (1) (identisch mit Abb. 4): **Kreuze**: aus der Magnetik bestimmte Werte; **rote Dreiecke**: aus Grabungen bestimmte Kalibrationspunkte. **Blaue Kurven**: modellierte Daten für eine Modellfamilie, bei der die Dichte der Lehmschichten variiert wurde; Modellparameter siehe Legende, Tabelle 1 und Abb. 2.

Die angewendete Schwund-Funktion muss noch in einem weiteren Punkt hinterfragt werden. Etwas rätselhaft ist der konstante Term m_0 , der ja besagt, dass von jedem Haus, unabhängig von seiner Grundfläche, ca. 2 t *Daub* fehlen. Mathematisch ist er nötig, denn er ist für die Krümmung der Flächendichte-Massen-Kurven in Abb. 1 (rechts) bzw. für ihre Korrektur verantwortlich.

An diesem Punkt muss bedacht werden, dass eine Grundannahme der Modelle ist, dass sämtlicher verbauter Lehm derart gebrannt wurde, dass er einheitlich magnetisiert wurde. Denkbar und vielleicht eher wahrscheinlich ist jedoch, dass der Lehm ungleichförmig metamorphisiert und magnetisiert wurde, und zwar in Abhängigkeit von Größe und Bauart eines Hauses, von der Temperaturverteilung und der Sauerstoffzufuhr im brennenden Haus und von der Ausgangszusammensetzung des Hauslehms. So könnte bei kleinen Häusern vielleicht nur eine geringe oder überhaupt keine Magnetisierung erzeugt worden sein, wenn die Brandtemperaturen nicht hoch genug waren. Die Magnetik

würde dann für diese Häuser keine oder verringerte Massen anzeigen und der Massen-Schwund wäre nur ein scheinbarer.

Leider liegen bisher zu wenig Kenntnisse über den Zusammenhang zwischen den genannten Faktoren und der Magnetisierung und Magnetisierbarkeit des Lehms vor, so dass der Brennprozess noch nicht modellmäßig gefasst werden kann. Eine Aufgabe für die Zukunft.

Scheinbarer Schwund sollte in der Kalibrierfunktion eigentlich berücksichtigt sein. Jedoch basiert im vorliegenden Fall (Pickartz *et al.* 2019) die Kalibrierung nur auf 3 Gebäuden, die nicht das gesamte Größen- und Bauart-Spektrum abdecken. Außerdem ist über die Menge der am Ort noch vorhandenen kleinen, bei der Grabung nicht erfassten *Daub*-Partikel nichts Quantitatives bekannt, so dass auch in dieser Hinsicht noch Potenzial für Verbesserungen ist.

Es ist daher sehr gut möglich, dass mit dem Wissensfortschritt in Zukunft zumindest der scheinbare Schwund weiter schwindet.

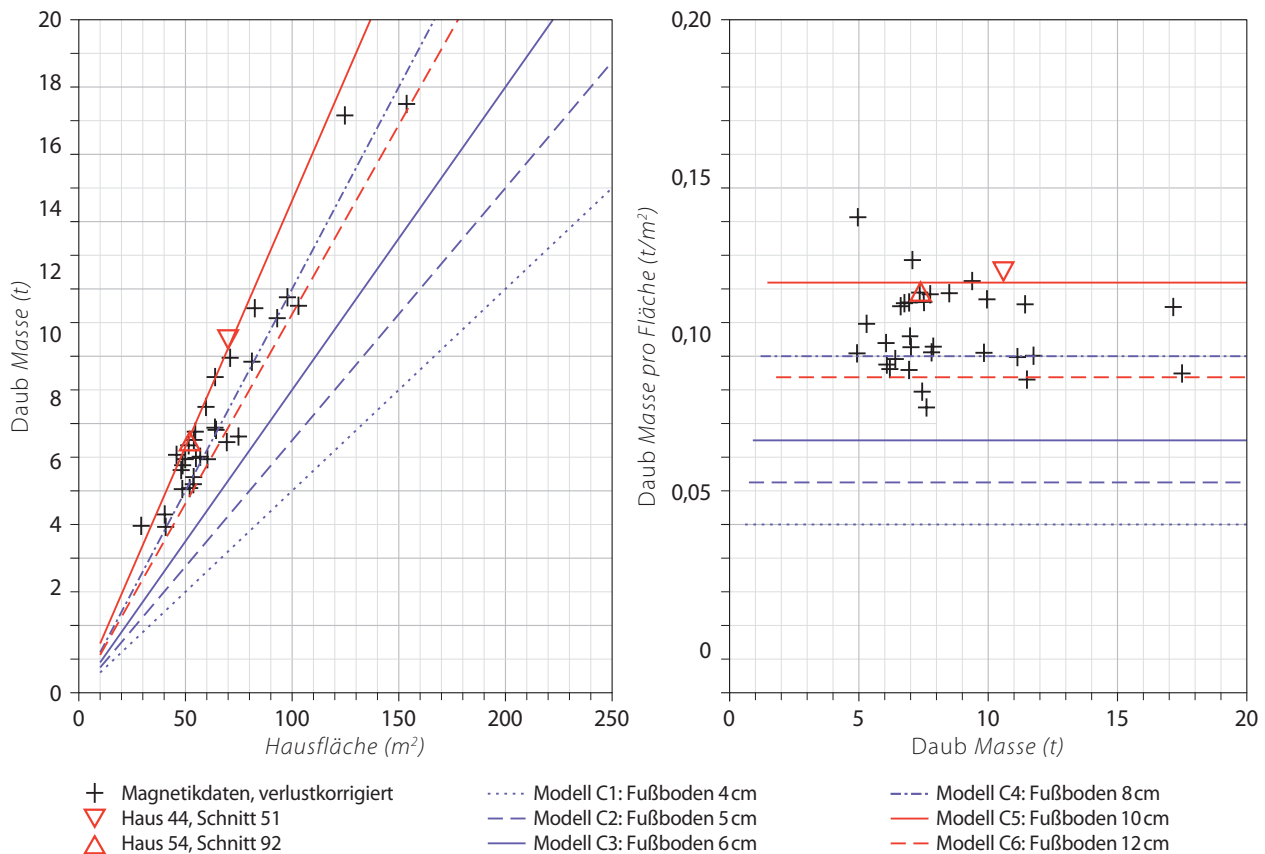


Abb. 7. Grundflächen, Daub-Massen und Daub-Flächendichten von Tripolje-Häusern. Felddaten nach Anwendung der Massenschwund-Korrektur nach Gleichung (1) (identisch mit Abb. 4): **Kreuze**: aus der Magnetik bestimmte Werte; **rote Dreiecke**: aus Grabungen bestimmte Kalibrationspunkte. **Blaue Kurven**: modellierte Daten für Gebäude ohne Wandputz, bei denen die Dicke des Fußbodenlehms variiert wurde; Modellparameter siehe Legende, Tabelle 1 und Abb. 2.

FINALE

Ich komme jetzt auf die in der Einleitung aufgeworfene Frage zurück, ob die mit Hilfe der Magnetik ermittelten Werte der Brandlehm-massen und die Systematiken, die sich in den Punktwolken der entsprechenden Diagramme andeuten, rechnerisch nachvollzogen werden können, wenn man einfache Modelle der Lehmbedarfs beim Hausbau zugrunde legt.

Die Antwort lautet „Ja“, nur muss man hinzufügen: „... vorausgesetzt, man ergänzt eine Abschätzung des realen und scheinbaren Schwundes der Daub-Volumina durch Erosion, Verschleppung und unvollständige Funderfassung“.

Es bleibt also noch einiges zu tun, um die magnetische Methodik der Daub-Massen-Bestimmung auf

einen festeren Untergrund zu stellen. Wünschenswert ist unter anderem eine Erweiterung der Felddatenbasis und der geologischen und geophysikalischen Probenanalytik dergestalt, dass die Randbedingungen, die für die magnetischen Inversionsrechnungen und die anschließenden Modellierungen benötigt werden, experimentell und statistisch zufriedenstellend abgesichert sind, zum Beispiel hinsichtlich des scheinbaren Daub-Schwundes aber auch hinsichtlich der Magnetisierung der Daub-Stücke und ihrer Fragmente im Boden.

Das Gespenst der Diskrepanz zwischen Modell- und Messwerten, das sich zu Beginn gezeigt hat, konnte etwas eingeeht werden, eingesperrt in seiner Flasche ist es noch nicht.

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Digging for (in)equality?

Measuring the Social Impact of Ditched Enclosures Building in South Portugal

António Carlos Valera

KEYWORDS: social inequality, ditched enclosures, architectural energetics, late Neolithic, South Portugal

“Nothing is more obvious and at the same time hidden than the link between monumentality and labor.”
(Bernbeck 2019, 133)

Abstract

The capacity for labour mobilisation has been a variable central to debate on the degree of social inequality achieved in Iberia during the 3rd millennium BCE. However, the evaluation of its economic and social impact has rested mainly in the logics of theory and perceptions and less in objectified data. This paper, following an architectural energetics approach, evaluates the work involved in monumental constructions, using as data base 25 ditched enclosures from inner Alentejo (South Portugal), corresponding to 74 ditches from the second half of the 4th and 3rd millennium BCE. The study allowed to recognize an increasing investment over time in these constructions regarding the number of enclosures, the enclosed areas, the number of ditches

and their dimensions. It quantifies the costs that could have been involved in the opening of these ditches, objectifying the evaluation of their social and economic impacts and providing parameters for further comparisons. It concludes that most of the analysed enclosures involved relatively low levels of work concentration and were accessible to small communities, not implicating levels of institutionalized social inequality. Differences regarding the large ditched enclosures were detected, showing a much higher levels of mobilization, and their implications are debated considering the more diversified set of ideological resources for recruitment and motivation that these large sites incorporate.

Zusammenfassung

Die Fähigkeit Arbeitskräfte zu mobilisieren war ein zentraler Faktor in der Debatte über das Ausmaß der sozialen Ungleichheit auf der Iberischen Halbinsel im 3. Jahrtausend v. Chr. Die Bewertung ihrer wirtschaftlichen und sozialen Auswirkungen beruhte jedoch hauptsächlich auf theoretischen Überlegungen und Wahrnehmungen und weniger auf objektiven Daten. In diesem Beitrag wird anhand eines architektonisch-energetischen Ansatzes der Arbeitsaufwand für monumentale Bauwerke ermittelt. Als Grundlage dient eine Datenbasis von 25 Grabenanlagen aus dem inneren Alentejo (Südportugal), die 74 Gräben aus der zweiten Hälfte des 4. und 3. Jahrtausends v. Chr. enthalten. Die Studie ermöglicht es, einen im Laufe der Zeit zunehmenden Aufwand für diese Bauten hinsichtlich der Anzahl der Anlagen, der umschlossenen Flächen,

der Anzahl der Gräben und ihrer Abmessungen festzustellen. Sie quantifiziert die Kosten, die für die Anlage dieser Gräben entstanden sein könnten, objektiviert die Bewertung ihrer sozialen und wirtschaftlichen Auswirkungen und liefert Parameter für weitere Vergleiche. Sie kommt zu dem Schluss, dass die meisten der analysierten Einfriedungen einen relativ geringen Arbeitsaufwand erforderten und für kleine Gemeinschaften zugänglich waren, ohne dass dies zu einer institutionalisierten sozialen Ungleichheit führte. Es wurden Unterschiede bei den großen Grabenanlagen festgestellt, die einen viel höheren Mobilisierungsaufwand erforderten, und ihre Auswirkungen werden unter Berücksichtigung der vielfältigeren ideologischen Ressourcen für die Rekrutierung und Motivation, die diese großen Anlagen mit sich bringen, diskutiert.

Resumo

A capacidade de mobilização de trabalho tem sido uma variável central no debate sobre os níveis de desigualdade social alcançado na Península Ibérica durante o 3.º milénio a.C. No entanto, a avaliação do seu impacto económico e social tem-se baseado sobretudo na lógica da teoria e de percepções e menos em dados objectivados. Este artigo, seguindo uma abordagem da Architectural Energetics, avalia o trabalho envolvido em construções monumentais, utilizando como base de dados 25 recintos de fossos do Alentejo interior (Sul de Portugal), correspondentes a 74 fossos da segunda metade do IV e III milénio a.C. O estudo permitiu reconhecer um investimento crescente ao longo do tempo nestas construções no que diz respeito ao número de recintos, às áreas encerradas, ao número de fossos e

às suas dimensões. Quantifica os custos que poderiam ter estado envolvidos na abertura destes fossos, visando a avaliação dos seus impactos sociais e económicos e fornecendo parâmetros para futuras comparações. Conclui-se que a maioria dos recintos analisados envolvia níveis relativamente baixos de concentração de trabalho e eram acessíveis a pequenas comunidades, não implicando níveis de desigualdade social institucionalizada. Foram detectadas diferenças em relação aos grandes recintos de fossos, que apresentam níveis de mobilização muito mais elevados, e as suas implicações são debatidas considerando o conjunto mais diversificado de recursos ideológicos de recrutamento e motivação que estes grandes locais incorporam.

INTRODUCTION

During the second half of the 4th and most of the 3rd Millennium BCE Iberia developed a trajectory of increasing social complexity that, with regional asymmetries, was characterized by demographic growth, production intensification, development of large-scale interaction networks and significant investments in monuments and other forms of ideological display (Valera 2015; 2021; Balsera *et al.* 2015; Blanco-González *et al.* 2018; Díaz-del-Río 2021). Within this chronological span, expressing and recursively acting on this social trajectory, ditched enclosures were one of the main scenarios of those investments, not just in the ceremonial activities they hosted (*e.g.* feasting, funerary), but also in the periodic and intense activity of opening, reopening, and filling ditches and pits. With different sizes (from tens of square meters to tens or hundreds of ha) and different temporalities (from few decades or centuries to more than a millennium), they represented a concentration of considerable collective work, involving organization, planning, considerable logistics, a production capable of supporting those investments, the existence of leadership (more temporary or more permanent — Gregory Johnson 1982) and a certain amount of “social manipulation” (Díaz-del-Río 2021, 193), generating some levels of concentration of power and of social asymmetry.

One of the main variables used to evaluate this growing social complexity is the ability to congregate communal work for monumental constructions. In Iberia, this capacity for labour mobilisation and investments has been considered as a representation of social relations of diverse nature within different theoretical models: of exploitation and institutionalized inequality in the context of the development of proto-state or

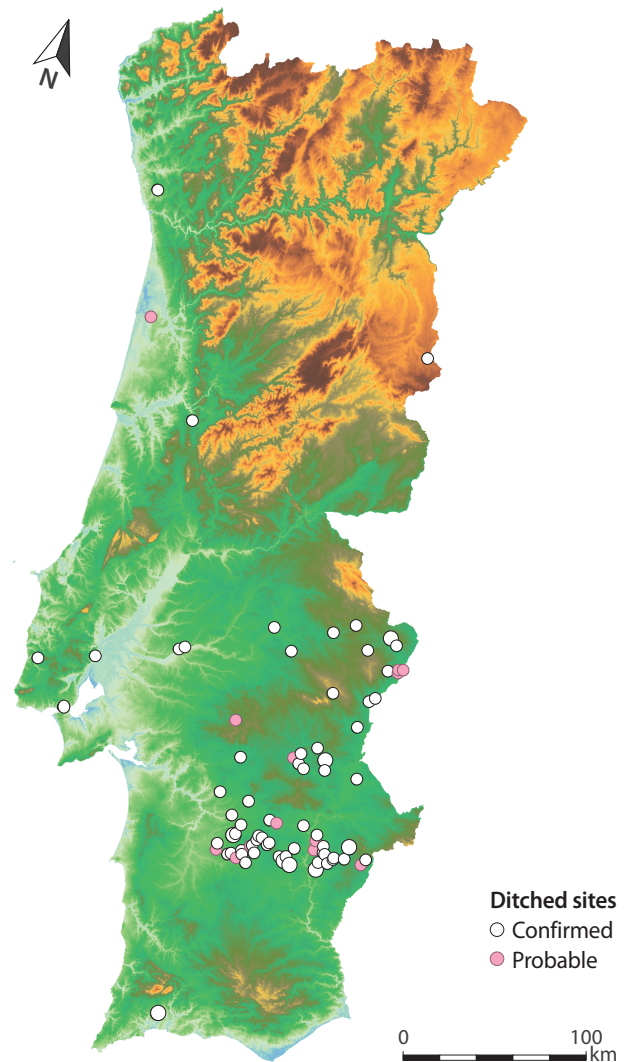


Fig. 1. Ditched sites in Portugal.

state conditions (Arteaga 2001; Nocete 2001; Morán and Parreira 2014), or a mechanism to prevent wealth concentration and preserve some levels of reciprocity and political negotiation (García Sanjuán and Díaz-del-Río 2006; Gilman 2013; García Sanjuán and Murillo-Barroso 2013; Risch 2017; 2018; Díaz-del-Río 2021). However, the evaluation of the economic and social impact of these earthworks, namely in the amount of work involved, has rested mainly in the logics of theory and in perceptions generated by the number and size of the ditches or by the magnitude of some enclosures.

Nonetheless, the labour spent in building projects such as ditched enclosures and other constructions of Prehistoric monumentality can be objectively approached (Buccellati 2019a), as shown by calculations applied to European megalithism (Müller 1990) and to several pre-classic and American contexts (Bernbeck 2019), objectifying expressions such as “significant

amount of people” or “substantial collective work”. In Iberia, though, these efforts are still rare and, to date, only a couple of studies have provided a quantitative approach to the labour involved in Neolithic and Chalcolithic ditched enclosures (Bernabeu Aubán *et al.* 2006; Villalobos García 2016).

Because the amount of work spent in nonproductive activities and its distribution over time have obvious implications in our considerations about the economy and social and political organization of these communities, it is vital to extend this approach to other Iberian regions, allowing for a more empirically supported conjecturing. So, we present a first attempt to access the work involved in the opening of ditches of enclosures from the inner Alentejo region, in South Portugal, dated between 3500 and 2000 BCE, to establish the diachronic tendency of those investments, and to appraise their economic and social relevance.

SITES AND METHODS

This approach uses architectural energetics (Abrams and Bolland 1999; McCurdy and Abrams 2019) applied to Alentejo's ditched enclosures. It allows the quantification of the costs involved in a construction, objectifies the impact evaluation and provides parameters for further comparisons.

In the inner Alentejo, 58 confirmed Neolithic and Chalcolithic ditched enclosures are recorded, plus 14 possible ones (Fig. 1). 25 of them were used in the analysis, corresponding to 74 ditches (Table 1). In face of the great diversity of the levels of information per site, the criteria for selection were the presence of excavated sections in the ditches, the existence of complete or almost complete plans of the ditches (obtained by excavation, geophysics, or satellite images), and information on the chronology (absolute and relative) of the sites/ditches. Most of the plans were attained using magnetograms (19 – the largest corpus for an Iberian region), which were acquired primarily in a research programme conducted at ERA Arqueologia S.A. (Fig. 2).

The dimensions of the ditches were established by calculating the width and depth of the excavated sections. When a ditch had more than one section, the average was taken. This allowed to detect a correlation between both measures and establish a set of class intervals that made it possible to classify the average size of the ditches when width was determined in the magnetograms, extending the empirical bases of analysis to enclosures only with geophysics (Fig. 3). This classification was used to analyse the diachronic behaviour of the ditch size, while areas (in ha) were used for enclosures size.

To determine the amount of work involved in the ditch opening, we started with the ditches with complete plans (or almost complete plans, allowing acceptable extrapolation of the missing parts) and with excavated sections (40 ditches). Through the section's profiles, the volume of a section of 1 m width was calculated (section area $\times$ 1 m) and then multiplied by the perimeter (or estimated perimeter) to obtain the total volume of the ditch, assuming the ditch maintains the same general form. Then, the total weight (mass) of the excavated material, expressed in tons, was calculated by multiplying the total volume by the density (kg/m^3) of the rock corresponding to each substratum, using available values for the weight of rocks from Alentejo's geological formations. Two main densities were used: $2800\text{ kg}/\text{m}^3$ for gabrodiorite, diorite and granitic substrata, and $2400\text{ kg}/\text{m}^3$ for carbonated topping substrata. Finally, to express the amount of labour in person/day work, the total volume was multiplied by the number of days one person would take to excavate 1 m^3 , using the coefficient of 2.6 days proposed by Rodrigo Villalobos (2016), based in the coefficients suggested by Christian Petersen and Robert Drennan (2012), to favour comparative analysis. However, because of the significant difference in mass of the types of substrata, a slightly smaller coefficient of 2.4 days/person per 1 m^3 was used for ditches excavated in the carbonated topping. Then, using the established width/depth correlation, that allowed to assume an average size of the ditches only with width measures, the analysis was extended to the enclosures that only have geophysics and surface observations (34 ditches).

ENCLOSURES WITH EXCAVATIONS OR WITH EXCAVATIONS AND GEOPHYSICS													
Site	Structure	Width		Depth		1m sect. volume	Peri- meter	Vol.	Mass	Area	General Chrono- logy	Person/ day	Person/ month
		m	μ	m	μ								
Perdigões	Ditch 1	6.50		3.00		10.50	1475	15487.5	43365.0	163105	Chalcolithic	40267.5	1342.00
	Ditch 2	6.00		2.60		9.20	1328	12218.0	34209.0	137468	Chalcolithic	31765.8	1059.00
	Ditch 3	4.70		1.60		3.10	772*	2393.0	6701.0	42120	Chalcolithic	6222.3	207.00
	Ditch 4	2.70		2.00		2.10	766*	1609.0	4504.0	40247	Chalcolithic	4182.4	139.00
	Ditch 5 S1	1.40	1.50	1.10	0.8	0.70	159	111.0	312.0	1862	Late Neolithic	289.4	9.60
	Ditch 5 S2	1.55		0.55									
	Ditch 6	3.00		1.90		3.60	199	716.0	2006.0	2901	Late Neolithic	1862.6	62.10
	Ditch 7	3.80		2.80		4.30	380	1634.0	4575.0	8924	Chalcolithic	4248.4	141.60
	Ditch 8	2.80		1.40		2.10	421	884.0	2475.0	12803	Late Neolithic	2298.7	76.60
	Ditch 10	1.70		0.60		0.80	1218*	974.4	2728.0	115885	Chalcolithic	2533.44	84.40
	Ditch 11	3.20		1.50		3.50	1431*	5008.5	14023.8	156710	Late Neo- lithic	13022.1	434.10
	Ditch 12 S1	1.55	1.30	1.00	0.8	0.85	176	150.0	419.0	2280	Late Neolithic	389.0	13.00
	Ditch 12 S2	1.00		0.55									
	Ditch 13	1.50		0.70		0.60					Middle Neo.		
	Ditch 14	0.90	1.10	0.60	0.5	0.35					Middle Neolithic		
	Ditch 14	1.35		0.35									
	Ditch 15	0.40		0.30		0.09					Middle Neolithic		
Santa Vitória	Ditch 1 S1	2.60	2.00	1.20	1.1	1.16	69	80.0	224.0	283	Chalcolithic	208.1	6.90
	Ditch 1 S2	1.70		1.15									
	Ditch 1 S3	1.90		1.00									
	Ditch 2 S1	1.20	1.80	0.80	1.0	1.00	178*	178.0	498.0	2036	Chalcolithic	462.8	15.40
	Ditch 2 S2	1.50		1.10									
	Ditch 2 S3	2.40		1.10									
	Ditch 2 S4	2.00		1.00									
	Outeiro Alto 2	Ditch 1 S1	2.30	2.70	1.60	1.6	2.80	101	283.0	679.0	562	Chalcolithic	678.700
Ditch 1 S2		3.00	1.60										
Alto do Outeiro	Ditch 1	2.20		1.50		2.30					Chalcolithic		
	Ditch 2	2.60		1.80		x					Chalcolithic		
Coelheira 1/2	Ditch 1a	1.80	1.40	0.62	0.64	0.69	50.0	35.00	83.000	195	Chalcolithic	82.800	2.80
	Ditch 1b	1.06		0.65									
	Ditch 2a	1.33	1.16	0.86	0.95	0.88	85.0	75.00	180.000	525	Chalcolithic	179.500	6.00
	Ditch 2b	1.00		1.04									
Montoitto	Ditch 1	2.10		1.55		2.14	499.0	1067.86	2990.008	1260	Chalcolithic	2776.436	92.50
	Ditch 2	3.10		2.70		4.11	426.0	1750.86	4902.408	13720	Chalcolithic	4552.236	151.70
	Ditch 3	1.70		1.35		1.02	145.0	147.90	414.120	19056	Chalcolithic	384.540	12.80
Porto Torrão	Ditch 1	3.50		3.00		3.10					Late Neolithic		
	Ditch 2	5.90		3.40		8.92					Chalcolithic		
Monte da Contenda	Ditch 1	2.60		1.00		2.37					Late Neolithic		
Horta Nova	Ditch 2	1.00	1.00	0.50	0.60	0.55					Late Neolithic		
	Ditch 2	1.00		0.70									

ENCLOSURES WITH EXCAVATIONS OR WITH EXCAVATIONS AND GEOPHYSICS

Site	Structure	Width		Depth		1 m sect. volume	Peri- meter	Vol.	Mass	Area	General Chrono- logy	Person/ day	Person/ month
		m	μ	m	μ								
Monte das Cabeceiras 2	Ditch 1	2.60	2.30	1.70	1.40						Chalcolithic		
	Ditch 1	2.20		1.10									
	Ditch 2	4.00	3.70	2.00	2.15						Chalcolithic		
	Ditch 2	3.40		2.30									
	Ditch 3	4.00	3.20	2.40	2.45						Chalcolithic		
	Ditch 3	2.40		2.50									
	Ditch 4	4.50	4.75	2.70	2.95						Chalcolithic		
	Ditch 4	5.00		3.20									
	Ditch 5	2.60	2.60	1.70	2.10						Chalcolithic		
	Ditch 5	?		2.50									
	Ditch 6	3.00		3.20							Chalcolithic		
Horta do Albardão 3	Ditch 1	2.20		2.00		1.55					Chalcolithic		
Juromenha 1	Ditch 1	2.50		1.70		4.41	407.0*	1794.87	5025.636	11810	Late Neo-lithic	4666.662	155.60
	Ditch 2	0.80		0.60			166.0			2077	Late Neo-lithic		
Torrão	Ditch 1	1.50		1.00		0.55	174.6*	96.03	268.900	2356	Late Neo-lithic	249.700	8.30
Horta do Pinheiro 6	Ditch 1	1.50		0.60							Late Neolithic		
Cortes 1	Ditch 1	2.50	2.75	0.50	0.50	0.98					Middle Neolithic		
	Ditch 1	3.00											
Bela Vista 5	Ditch 1		1.90		0.85	x	22.0	x	x	34	Early Bronze Age		
	Ditch 2		1.85		0.80	x	101.0	x	x	672	Early Bronze Age		

ENCLOSURES ONLY WITH GEOPHYSICS AND SURFACE OBSERVATIONS

Site	Structure	Width		Depth		1 m sect. volume	Peri- meter	Vol.	Mass	Area	General Chrono- logy	Person/ day	Person/ month
		m	μ	m	μ								
Xancra	Ditch 1		3.00			4.80	64.0	307.20	x	279	Chalcolithic	798.720	26.624
	Ditch 2		4.00			4.80	217.0	1041.60	x	3313	Chalcolithic	2708.160	90.272
	Ditch 3		2.00			2.69	496.0	1334.24	x	14650	Chalcolithic	3469.024	115.634
Borrachos	Ditch 1		2.40			2.69	64.0	172.16	x	282	Chalcolithic	447.616	14.921
	Ditch 2		2.50			2.69	103.0	277.07	x	476	Chalcolithic	720.382	24.013
	Ditch 3		3.00			2.69	197.0	529.93	x	1860	Chalcolithic	1377.818	45.927
	Ditch 4		1.80			0.75	221.0	165.75	x	3368	Chalcolithic	430.950	14.365
	Ditch 5		1.50			0.75	210.0	157.50	x	3213	Chalcolithic	409.500	13.650
	Ditch 6		1.60			0.75	386.0	289.50	x	7562	Chalcolithic	752.700	25.090
	Ditch 7		2.60			2.69	356.0	957.64	x	8165	Chalcolithic	2489.864	82.995

ENCLOSURES ONLY WITH GEOPHYSICS AND SURFACE OBSERVATIONS													
Site	Structure	Width		Depth		1 m sect. volume	Peri- meter	Vol.	Mass	Area	General Chronol.	Person/ day	Person/ month
		m	μ	m	μ								
Herdade da Laje	Ditch 1		1.70			0.75	80.0	60.00	x	434	Chalcolithic	156.000	5.200
	Ditch 2		2.00			2.69	209*	562.21	x	2729	Chalcolithic	1461.746	48.725
	Ditch 3		2.50			2.69	436*	1172.84		11489	Chalcolithic	3049.384	101.646
Rouca 7	Ditch 1		1.80			0.75	53	39.75		220	Chalcolithic	103.350	3.445
	Ditch 2		2.50			2.69	153	411.57		1501	Chalcolithic	1070.082	35.669
Monte do Olival 1	Ditch 2		2.20			2.69					Chalcolithic		
	Ditch 3		1.00			0.75	168	126.00		2188	Chalcolithic	327.600	10.920
Folha do Ouro	Ditch 1		2.40			2.69	98	263.62		637	Chalcolithic	685.412	22.847
	Ditch 2		3.50			4.80	252	1209.60		3670	Chalcolithic	3144.960	104.832
	Ditch 3		2.60			2.69	448	1205.12		12475	Chalcolithic	3133.312	104.444
	Ditch 4		2.50			2.69	458	1232.02		16348	Chalcolithic	3203.252	106.775
	Ditch 5		1.75			0.75	678	508.50		29424	Chalcolithic	1322.100	44.070
	Ditch 6		2.00			2.69	660	1775.40		34135	Chalcolithic	4616.040	153.868
Moreiros 2	Ditch 1		2.30			2.69	194*	521.86	1461.208	2260	L. Neolithic	1356.836	45.228
	Ditch 2		1.90			0.75	357	267.75	749.700	9015	L. Neolithic	696.150	23.205
Monte do Trigo	Ditch 1		0.90			0.75	133	99.75	279.300	1105	L. Neolithic	259.350	8.645
	Ditch 2		2.00			2.69	184	494.96	1385.888	2082	L. Neolithic	1286.896	42.897
	Ditch 3		1.50			0.75	381	285.75	800.100	9855	L. Neolithic	742.950	24.765
	Ditch 4		1.50			0.75	741	555.75	1556.100	35956	L. Neolithic	1444.950	48.165
	Ditch 5		1.80			0.75	794	595.50	1667.400	42644	L. Neolithic	1548.300	51.610
Salvada	Ditch 1		4.00			4.80	1507	7233.60	20254.080	173962	Chalcolithic	18807.360	626.912
	Ditch 2		4.00			4.80	1415	6792.00	19017.600	152063	Chalcolithic	17659.200	588.640

* Ditches with part of the perimeter extrapolated.

Naturally, there are several circumstances that must be considered when evaluating results. There are some variables assumed as constants (such as the dimensions of a ditch along its perimeter, or the productivity of each worker and the daily working time), and there are several extrapolations involved, based on experimental archaeology and ethnographic data, some concerning the features, others related to the coefficients used. On the other hand, considering that the approach to building costs should be done assuming building as a “operational sequence” or a “behavioural chain” (Buccellati 2019a, 42–43), we are addressing just one moment of a sequence (the opening of a ditch), not assessing other investments in the constructions (for instance, the preparations of the ground previous to excavation, the production of tools, what was done with the extracted material, reopening of ditches, or the logistics behind all this). Another important aspect has to do with the periodicity of construction, since the opening was not necessarily restricted to a moment or undertaking. In fact, some ditches showed that they were built

by segments and, sometimes, when the new segment was opened the previous one was already filled, clearly attesting a construction differed in time (Valera 2023a). Finally, a negligence, to use the expression of Reinhard Bernbeck, common to these approaches is the unrealistic assumption of a stability in the relation person/day — amount of work, independently of the type of work, the duration of the work, of the people who realize it and of the strategies used to overcome “disutility work” (Bernbeck 2019). In fact, in the analyses of labour we must also consider the involved subjective aspects of it. A problem that this case study also suffers, but that we try to soften ahead.

Nevertheless, and despite these conditions, quantifications provide a more objective basis to consider the implications of the construction of these enclosures on economic, social, and political structures of the communities that built them, function as a heuristic tool and constitute a comparative basis for other regional studies.

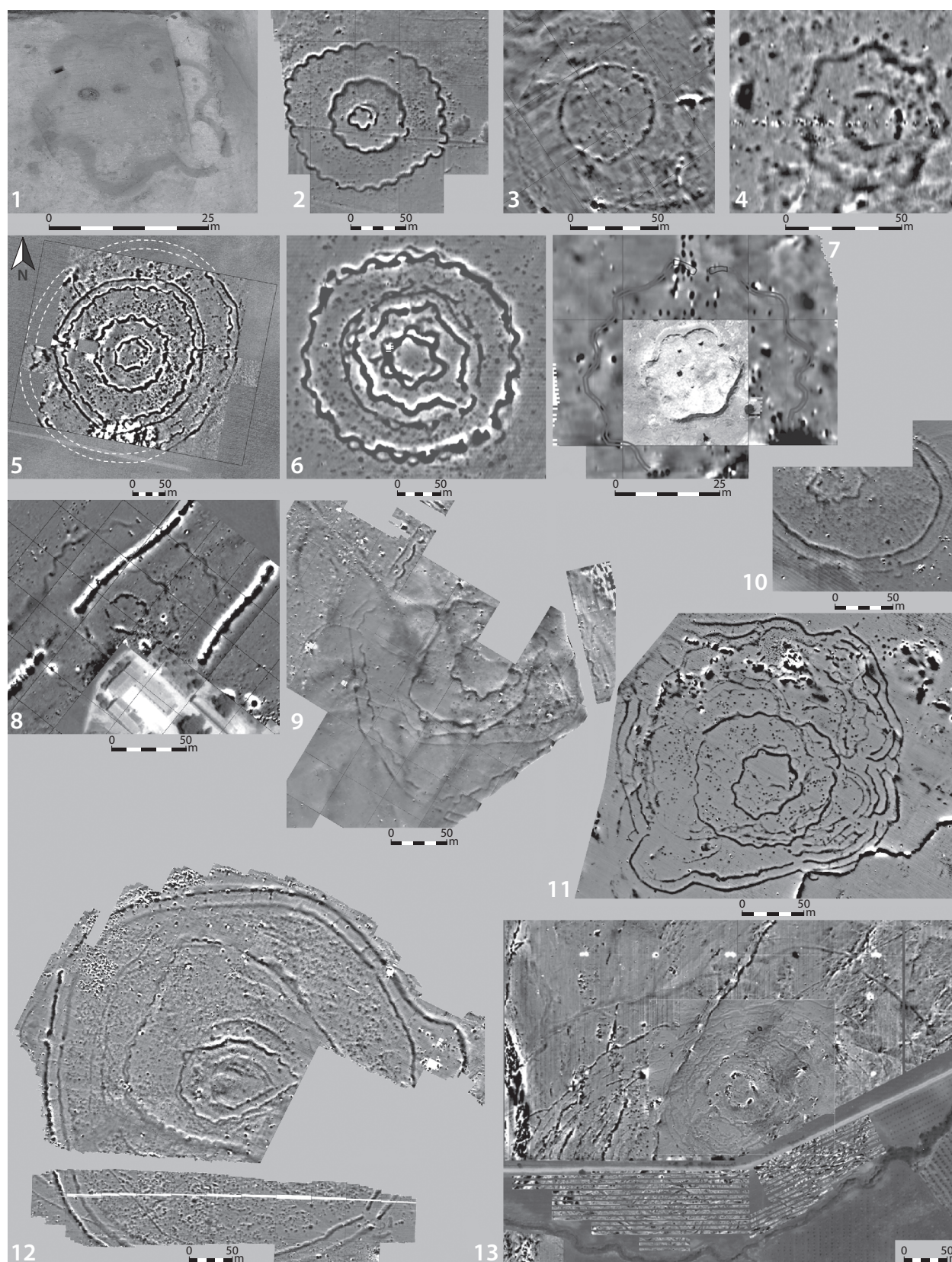


Fig. 2. Aerial images and magnetograms of some ditched enclosures from Alentejo region. 1 Outeiro Alto 2; 2 Xancra; 3 Monte do Olival 1; 4 Rouca 7; 5 Folha do Ouro; 6 Borrinhos; 7 Santa Vitória; 8 Herdade da Laje; 9 Moreiros 2; 10 Montoito; 11 Trigo (Charneca); 12 Perdigões; 13 Monte da Contenda.

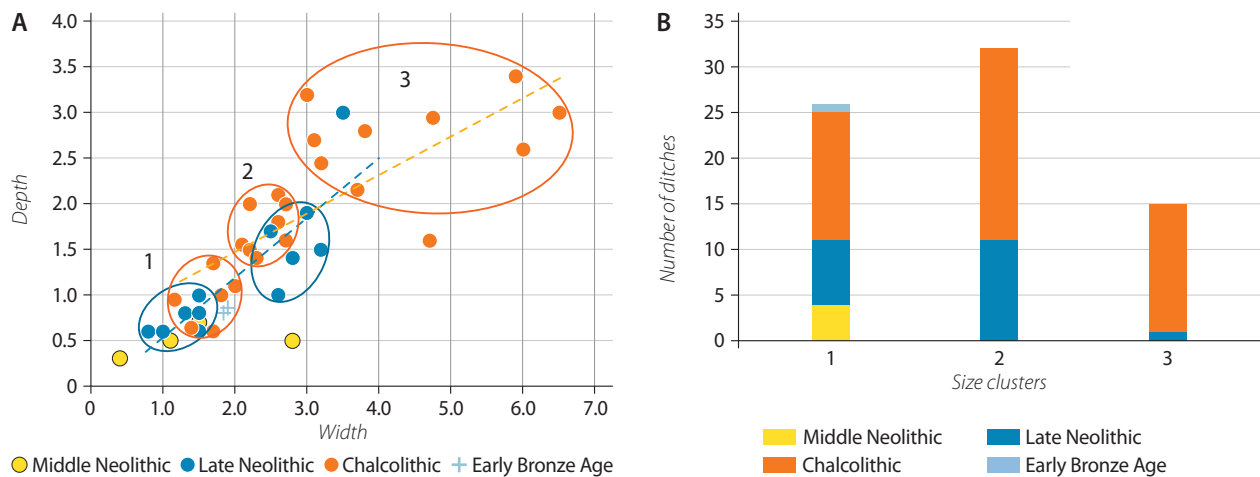


Fig. 3. **A** Size of ditches established by width and depth, establishing three clusters, the first two clusters are subdivided by chronology; **B** Ditches by size clusters and chronology, including the ones with width obtained in magnetograms and aerial images and average correlated depths.

THE SIZE OF DITCHES AND ENCLOSURES IN ALENTEJO (SOUTH PORTUGAL): A DIACHRONIC PERSPECTIVE

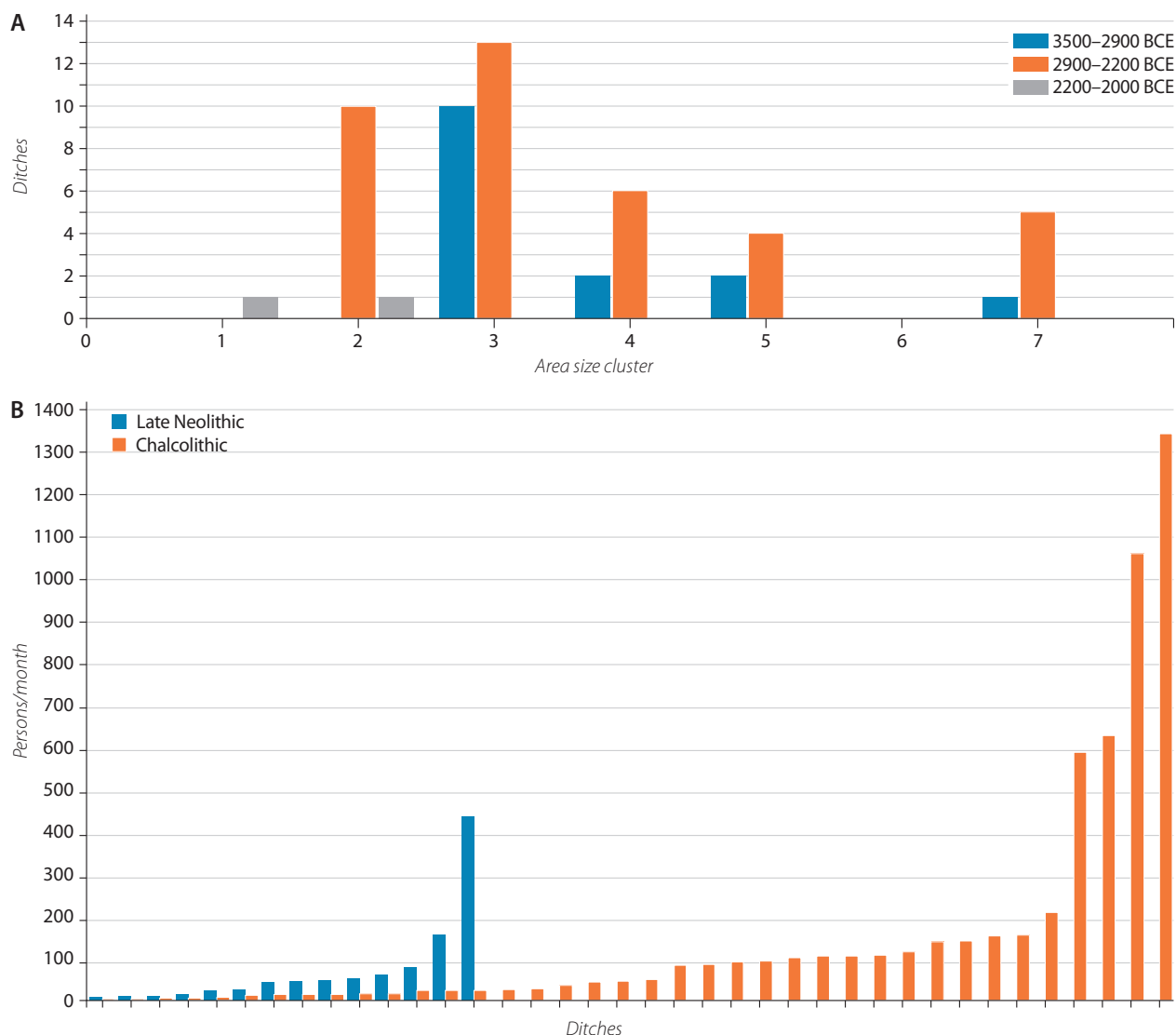
Of the 58 confirmed ditched sites, 15 still have no information of a specific chronology. The remaining 44, considering absolute and relative chronologies from excavations and surface observation, are distributed across the Late Middle Neolithic (3500–3300 BCE) with two cases (4 ditches), Late Neolithic (3300–2900 BCE) with 19 cases (42 ditches), Chalcolithic (2900–2200 BCE) with 27 cases (61 ditches), and Early Bronze Age (2200 to 2000 BCE) with only one case (2 ditches). The actual data show an abrupt increase of ditch construction from the middle to the late 4th millennium BCE, a continuous increment during the 3rd millennium BCE until its last quarter, when an abrupt decrease occurs.

Regarding ditch size, measurements were recorded in 42 ditches, corresponding to 16 enclosures, and were organized by four main periods according to available chronology (absolute and relative): Late Middle Neolithic (4 cases), Late Neolithic (12 cases), Chalcolithic (24 cases), and Early Bronze Age (2 cases). The distribution based on width (W) and depth (D) show a clustering in three groups, with three outliers (Fig. 3A): Cluster 1 (W: 0.5–2.0 m, D: 0.5–1.5 m), Cluster 2 (W: 2.0–3.5 m, D: 1.0–2.5 m), Cluster 3 (W: 3.0–6.5 m, D: 2.0–3.5 m). To extend the analysis to ditches only with widths obtained through geophysics or aerial images, we can use the average depth of each cluster (0.75 m and 1.50 m for two clusters of the Late Neolithic ditches, and 1.00, 1.50 and 2.75 m for the three clusters of the Chalcolithic ditches). This allows us to include 31 additional ditches from eight enclosures ascribed to the Late Neolithic (7 ditches) and from six Chalcolithic enclosures (24 ditches), for which there is

credible chronological information from surface evidence and good magnetogram images (Fig. 3B).

The main aspect to highlight in the distribution is the tendency for the increasing of size over time until the third quarter of the 3rd millennium BCE and an apparent size reduction in the Early Bronze Age. Late Middle Neolithic ditches are small, namely in depth (not passing 0.7 m) and with just one case wider than two meters. In the Late Neolithic, the ditches group in Clusters 1 and 2, with just one case in Cluster 3, while during the Chalcolithic they are evenly distributed across the three clusters. They group close to the Late Neolithic ditches in Cluster 1 and 2, but with slightly higher limits in terms of depth, and are almost exclusive in Cluster 3, corresponding to the larger features. Finally, the only two ditches dated from the Early Bronze Age integrate Cluster 1. However, if there is an increasing trend and a concentration of the larger ditches in the Chalcolithic, it is also evident that most of the ditch sizes group in Clusters 2 and 1 and that small ditches were built during the entire time span.

Regarding the size of enclosed areas, 55 ditches from 25 enclosures were used. The areas (expressed in ha) were grouped in seven clusters (C1 <0.01; C2 0.01–0.09; C3 0.10–0.99; C4 1.00–1.99; C5 2.00–4.99; C6 5.00–9.99; C7 10–20), considering only three periods (Late Neolithic, Chalcolithic and Early Bronze Age), since there is no information for the Late Middle Neolithic (Fig. 4A). Most enclosed areas are less than, but close to, one ha (Cluster 3), with similar numbers for the Late Neolithic and Chalcolithic. Larger areas also occur in both periods, but with more frequency during the Chalcolithic, namely in the higher cluster



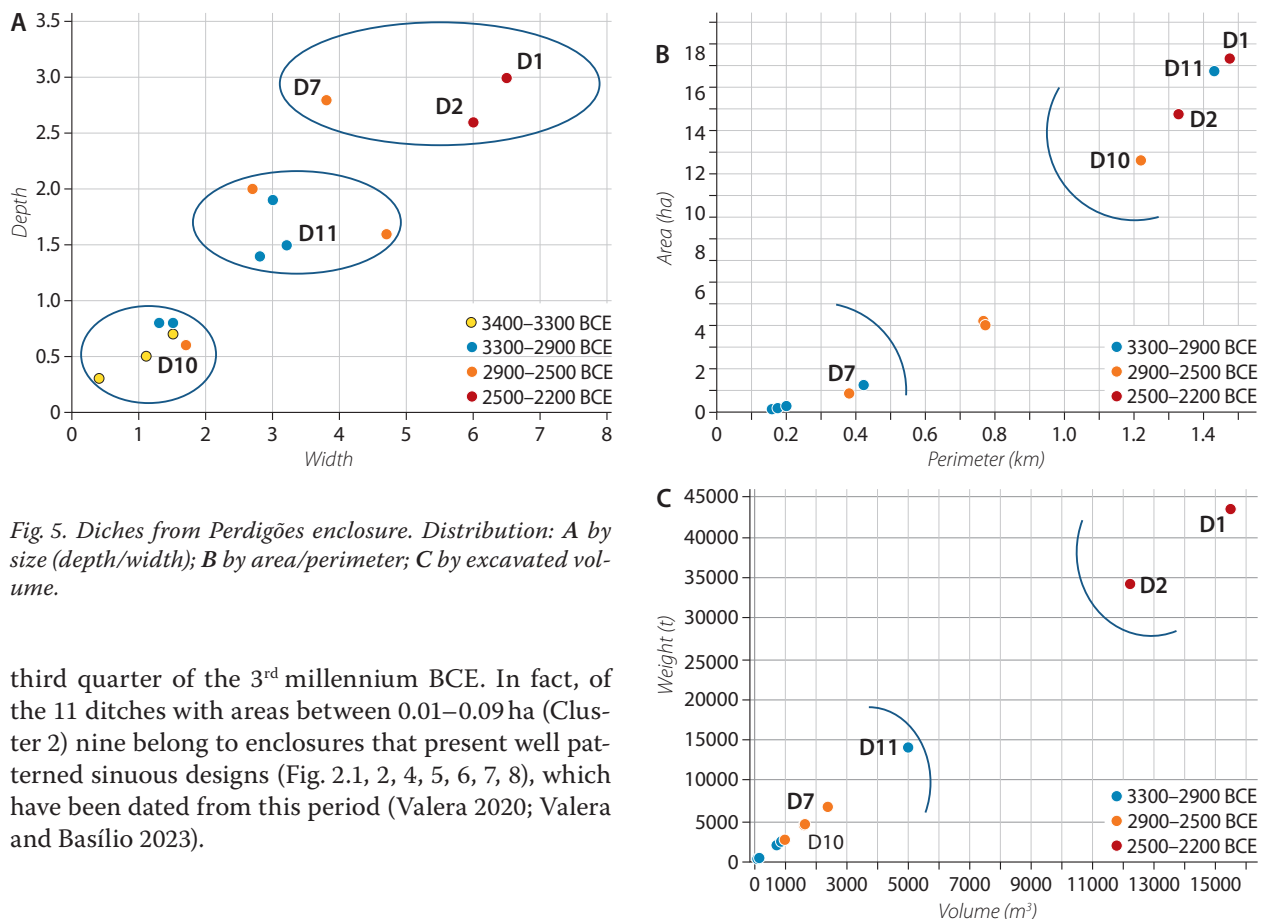


Fig. 5. Ditches from Perdigões enclosure. Distribution: A by size (depth/width); B by area/perimeter; C by excavated volume.

third quarter of the 3rd millennium BCE. In fact, of the 11 ditches with areas between 0.01–0.09 ha (Cluster 2) nine belong to enclosures that present well patterned sinuous designs (Fig. 2.1, 2, 4, 5, 6, 7, 8), which have been dated from this period (Valera 2020; Valera and Basílio 2023).

QUANTIFYING THE LABOUR INVOLVED IN OPENING DITCHES IN ALENTEJO (SOUTH PORTUGAL)

For the analysis of involved labour, 21 ditches with section and perimeter measurements were used. Another 31 with magnetogram plans were added using the average depth established for the size clusters (see above) and the width provided by geophysics. Only two main periods were considered (Late Neolithic and Chalcolithic, with 14 and 38 cases respectively) because there is no information for the perimeters of the Late Middle Neolithic enclosures and the construction of the ditches of Bela Vista 5 (the only from Early Bronze Age) were excavated by segments and with a great variability of measurements, which makes extrapolations more problematic. Nevertheless, the general size of these Middle Neolithic and Early Bronze Age ditches indicates low levels of invested labour.

The results, expressed in persons per month to favour the graphic presentation (Fig. 4B), are obviously aligned with the general image provided by ditch and area sizes, showing a general tendency for the increase of labour investments between the Late Neolithic and the Chalcolithic. Three aspects, though, must be highlighted:

- Most of the ditches (36–69%) needed less than 100 persons/month, followed by 11 ditches (21%) that required a labour investment between 101–208 pers./month. This means that 90% of the analysed ditches could be opened in one or two months without involving a significant concentration of workers. In fact, 56% of them would require less than 50 workers for one month, and 29% less than 20 workers. This circumstance is similar in both periods.
- Only five cases show higher investments in labour, forming two clusters: one between 434–627 pers./month (3–6%) and the other between 1059 and 1343 pers./month (2–4%). The ditches representing an amount of work over 500 pers./month all correspond to the Chalcolithic and are part of the largest ditched enclosures analysed (Perdigões and Salvada), with long and complex biographies. The same general amount of labour, or even higher, could be expected for other large ditched enclosures, like Porto Torrão, Monte das Cabeceiras 2, Herdade da Corte, and Monte da Contenda,

for which we still don't have all the necessary information to include them in this approach.

- There is a significant gap between the work needed to open the few ditches of the higher clusters

DISCUSSION

The analysis shows a trend of increasing labour investments in the construction of ditched enclosures between the middle of the 4th and the third quarter of the 3rd millennium BC, showing a decrease at the end of this millennium. This is observable in the number of sites, in the number of ditches, in the size of ditches and enclosed areas, and in the amount of work involved.

A first step to evaluate this investment is to consider the social implications of the volume of labour mobilization for each ditch in face of the existing population in the region.

The area of distribution of ditched enclosures in inner Alentejo is delimited to the North by the transition from the Guadiana to the Tagus basin, to the West by the geological transition between the old massive to the sedimentary littoral platform, to the South by the transition to the pyrite belt and at East by the Guadiana River (with a small territory in the left bank), presenting an area around 12100 km².

To estimate a demographic density for this region, and in the absence of demographic studies developed for the Portuguese Prehistory, we use the ratio of one individual per km² proposed by Pedro Díaz-del-Río (2021) for Iberia by the end of the 3rd millennium BCE, which proportionally compares with a correlation established for the European continent (Müller 2015). Naturally, the authors (and the users) of these studies of prehistoric demography are aware of the several assumptions and potential biases implied (for instance, the lack of the same levels of information for all regions and periods, or the heterogeneous character of population distribution over space and time). But, again, they have been proven useful as exploratory tools. So, based on that ratio 1 : 1, the number of individuals would be of 12100. This density assumes that opening each of 69% of the analysed ditches (the ones with less than a 100 persons/month) would require the labour of between 0.02% and 0.8% of this population for one month. That is not a significant proportion, even if we double the numbers accounting for a lower density for the late 4th and early 3rd millennium BCE.

On the contrary, Perdigões enclosure would demand the work of 11% of that population for a month to open the outside ditch (Ditch 1) and 20% if the two parallel outer ditches (Ditches 1 and 2) were built simultaneously. Proportionally to the regional estimated

and all the rest, a gap in labour investment that seems to be more related to the size of enclosures rather than the size of ditches (as referred above, there is a relatively weak correlation between enclosed areas and ditches in terms of size).

population, they represent a significant mobilization of labour force. And the perception of that capacity of mobilization is enhanced if the local settlement network of Perdigões, the Álamo valley with 244 km², is considered. We would have to more than quintuple the local demographics to match the requested labour to open just Ditch 1 in one month. Naturally, we could easily assume a much higher concentration of population in that fertile valley and a more extended period of construction, but even so, it would represent a considerable capacity of mobilization, that would probably have had to aggregate people and supplies from outside that local territory (as isotopic approaches to mobility of humans and animals have been documenting — Valera *et al.* 2020; Zalaite *et al.* 2018). More relevant, though, is that it reveals investments of a totally different scale from most of the enclosures of the region, that would be matched only by other large enclosures such as Porto Torrão, Monte da Contenda, Monte das Cabeceiras 2, Monte das Cabeceiras 3, São Brás 3 or Herdade da Corte. In fact, most of the ditched enclosures in Alentejo region did not involve high mobilization of labour, a circumstance that must not be hidden by the values required by the larger sites, for this discrepancy has obvious implications in the levels of production intensification needed to support the different investments and in the ability for mobilization.

This labour increase in the construction of enclosures and other types of monumental architecture during the Neolithic and Chalcolithic is commonly correlated with a significant increment in agricultural surplus, without which it is usually considered to have been impossible to support these investments, to the point where the former becomes an almost direct indicator of the second. However, an excessive dependence of monumentality in relation to agricultural production has been shown to be quite complex, for example, in Northern Europe (Bradley 1998). Furthermore, the construction of large-scale monuments has been recognized in economic contexts that are still exclusively or strongly foragers (of which Göbekli Tepe is a maximum exponent). As to the inner Alentejo, the review of direct and indirect data relating to agricultural production during the Late Neolithic (Valera 2018) showed that a significant agricultural intensification directly associated with, or inferred from, the

increasing monumentality during the second half of the 4th millennium BCE is not yet supported by the archaeological record. This indicates that the correlation Investments in Monumentality/Pressure over Productive Subsystem is not necessarily equal to one, that it varies in time and regionally (and perhaps within regions), and that investments in monumentality may indicate a variability of social and economic scenarios.

In fact, the cost evaluation of a construction is not independent of the forms/conditions of mobilization nor of ideology (Bernbeck 2019; Levenson 2019). More than just by-products and expressions of consolidated previous material and political conditions, these investments may constitute a decisive incentive within a trajectory of agrarian intensification and a source for generating and simultaneously controlling power (Bender 1989; Levenson 2019; Pauketat 2000). This means that the attention to labour costs and their evaluation must consider the role of ideology and its tremendous impact on building. Not just in the reasons behind a specific structure, but also in other factors, such as the choosing of the location for construction, the materials used, the size and design, and the motivation to work. Frequently, the ideological contributions are responsible for a lack of what we modernly call economic rationality, implicating significant additional investments in labour. The well sinuous patterned ditched enclosures of inner Alentejo are a good example of that. Their sinuosity extends the perimeter of the ditches without relevant change of the enclosed area. In one of them (Borrallhos; Fig. 2.6), the outer sinuous ditch was opened over a previous one instead of reopening it (we can see the overlapping of the two ditches in the magnetogram), implicating more excavation of the bedrock when emptying the previous ditch would have involved less work. The exuberant monumentalisation of entrances, as are the cases of Trigo (Fig. 2.11) for Late Neolithic or Perdigões (Fig. 2.12) for the Chalcolithic, or the disproportional size of some ditches in the large ditched enclosures are other examples of high investments of work that are not explainable by technical or functional advantages.

If the increase in the number of enclosures and in their areas can, at least in part, be explained by demographic growth, the increase in the size of the ditches requires other explanations. What functions have been proposed for the ditches? Physical delimitation of spaces with one or multiple purposes: defensive reasons, drainage, delimitation of significant spaces for specific practices. But if we pay attention to the size of most of the ditches (those classified in group 1 are 35.6%) the defence function would be inoperative (especially when no associated earth banks have been unquestionably documented). On the other hand, drainage systems would not require such large ditches and the

larger ones are disproportionate for both defence and drainage. Their gradual and intentional anthropic filling throughout the life of the sites is another argument against these more practical functions, which would be more inherent than primary. The functional and technical explanations also do not justify the well standardized sinuous enclosures (nor the design of the standardization), as it does not account for those built by segments (in which, sometimes, the previous segment is already filled when the next one is opened).

In many of these enclosures, it becomes clear that the labour involved is not just a condition for the construction, but that it is itself a purpose. The importance of the creation of the structure over the finalized construction, of the process over the achievement, has been frequently signalized (Edmonds 1999; Levenson 2019; Valera 2020). This means recognizing the “worker perspective”, the motivation and the strategies developed for conforming it, as variables relevant for the evaluation of the operating social mechanisms (Bernbeck 2019) and adopting a “performative approach” (Strum and Latour, 1987), where the social organization is perceived as emerging from the social relations and practices, rather than observing specific typified properties.

In Iberian prehistory, the debate around labour mobilization during the 3rd millennium BCE has been balanced between mechanisms of coercion and strategies of persuasion or cooperation. As referred above, the first is associated to the idea of an historical context of profound social inequalities, with stratification and institutionalization of those inequalities, and the development of proto-state or state conditions (Arteaga 2001; Nocete 2001; Soares 2013; Morán and Parreira, 2014). The second results from considering other historical circumstances (such as low demographic density, easy access to land, low technology, operating reciprocity networks, and fractal social organizations), which did not allow the development of strong social devices of exploitation (García Sanjuán and Díaz-del-Río 2006; Díaz-del-Río 2021), but were characterized by forms of cooperation that permitted demographic and economic growth, and allowed the development of strategies to prevent sectoral accumulation and political control (Hyden 1995; Risch 2017; 2018). In both theses, the growing investment of labour in forms of ideological display, namely in monumental enterprises such as ditched enclosures (or in the circulation and consumption of sumptuary materials), plays a central role in social dynamics, but in radically different ways. In the first case, resulting from a control of critical resources and a coercive (tributary) capture of surplus, this investment is directed to display and reinforce the prestige and political power of a dominant class. In the second, independently of the involved levels of individual or group prestige gain, it is seen as one of the mechanisms that

prevented segregated accumulation, contributing to the maintenance of reciprocity, negotiated decision-making, and collectivism (or moderate levels of inequality) in appropriation and consumption.

Looking at the data provided by ditched enclosures in Alentejo, the amount of work involved is relatively low for most of them. In fact, many would have a similar cost to middle-sized Neolithic megalithic monuments and were built all over the time span of enclosure building in the region. They would be accessible projects for relatively small communities and rapidly built, with periodic phases of expansion and rebuilding. This accessibility would be one of the reasons behind the proliferation of enclosures in some areas, sometimes just a couple kilometres distant (as in the Serpa area, South Alentejo), revealing a need for episodic investments of labour in monumental constructions or operating processes of low-level social emulation. In fact, most of these enclosures do not provide evidence of a relevant integration in large scale interaction networks or significant consumption of exotic and prestigious materials. As to leadership, these projects do not give us any reason to conceive their building within a regime of Persistent Institutionalized Inequality (Moreau, 2020). Rather, they seem to go well with more cooperative rituality (Müller 2010), where communal work acts as a mechanism of social cohesion and aggregation, where mobilization is based in ideological shared aspirations, in strategies of drudgery reduction (Levenson 2019; Bernbeck 2019) and redistribution such as “labour feasts” and other ceremonial practices of feasting (Dietler and Hayden 2001). For example, dividing the work by temporal units, as indicated by the construction by segments, would make the construction even more accessible to a small number of workers and would generate an incremented construction that also reduces drudgery and, by extending the construction processes, would reinforce the role of labour in both aggregation and exhibition of status.

However, the image that comes out of the amount of work involved in large ditched enclosures is totally

different. For instance, the level and certainly the processes of mobilization at the time Perdigões was at its prime, when the two outside ditches were opened, were much different from what happened contemporaneously at Santa Vitória (Valera and Basílio 2023). It involved not just more workers probably during more time to open two ditches of higher monumentality, more surplus to support it, but also the mobilization from outside the local settlement network and the use of other ideological and motivational resources that were not available at Santa Vitória. The already established symbolic status of the site with a long biography and aggregation role, represented by its emblematic and meaningful location within the local landscape, by the presence of ceremonial structures (such as a cromlech and a timber circle) and of funerary monuments (tholoi and other type of tombs), or by its integration in large scale interaction networks, provided an aura of sacredness and ancestry and powerful ideological resources for mobilization of communal work. The complexity involving the process was higher and more demanding, in people, in surplus, in strategies for mobilization and motivation.

Even so, nothing at this site suggests the presence of centralized and individualized forms of appropriation of material wealth, segregated consumption, or private control of exchange, that might support the presence of mechanisms of institutionalized coercion behind the work invested in monumental constructions, following the general scenario for the region (Valera 2019). On the contrary, the intense evidence of feasting (large consumption of animals in public open space) and of ceremonial activity in the central area of the enclosure, the complete dissolution of individuality in the ossuaries of tombs of collective use, the parity of richness of the votive assemblages in the several tombs (despite their typological differences), and the amortization of exotic objects and raw materials in these funerary contexts with no individual associations (Valera 2017; Valera 2023b), seem to indicate an ambiguous process of communal consumption, social emulation, and prevention of accumulation.

CONCLUSION

The quantitative analysis of the work invested in opening ditches throughout the second half of the 4th and 3rd millennia BCE in the interior of Alentejo (southern Portugal), despite the deviations inherent to the quality of the data and the extrapolations used, allows us to recognise an increasing investment in the construction of this type of structures, both in the number of enclosures and in the enclosed areas, and in the number of ditches and their dimensions. This is an increase

that accompanies a trajectory of social complexity equally characterized by demographic growth, productive rise, expansion, and intensification of large-scale interaction networks, growing consumption of exotic goods, iconographic productions, and investments in other forms of ideological display. However, despite this increase, it is noted that most enclosures and ditches are small and medium-sized, implying relatively small mobilization of labour for opening

ditches (assuming that the ditches of multi-ditched enclosures are not built simultaneously), and that they occur throughout the entire chronological spectrum covered by this phenomenon. This preponderance of small and medium-sized investments helps to explain the proliferation of these monumental constructions, their spatial proximity shown in several areas, or processes of periodic construction and possible alternation. This picture seems more consistent with persuasive or cooperative mechanisms of labour mobilization, accessible to different levels of economic capacity.

However, the contrast with large enclosures is significant. They require much higher levels of mobilization, both in number of workers/worktime and in area of recruitment, but also incorporate a more diversified set of ideological resources for recruitment and motivation. They seem to constitute scenarios for more intense social and political negotiation and control of (or even resistance to) the development of higher levels of social inequality. In that context, labour, in this case the work invested in opening ditches, would have played a relevant part.

In fact, social inequality is ubiquitous but presents variable patterns and intensities within a broad spectrum of negotiation and imposition of cultural norms on individual autonomy, being also present in purely forager societies (Moreau 2020). The question is not if it exists or not, but what form and complexity does it

takes in social terms and what mechanisms were used to develop it or to resist that development. Therefore, controlling it would require active social strategies and mechanisms of prevention, considering that human agency creatively manipulates structural conditions (Strum and Latour 1987; Johnson 1989). These communities were capable of producing “wealth”. However, that wealth does not seem to have resulted into institutionalized inequality in power that can be unquestionably recognized in the available archaeological data of the region until the late 3rd millennium BCE, suggesting operative mechanisms to prevent relevant sectorial material accumulation, among which were the investments in construction of ditched enclosures (both in construction costs or in motivation and negotiation strategies) or in the circulation, consumption and collective amortization of surpluses and exotic and prestigious materials.

However, these mechanisms incorporate risks, for they promote other forms of inequality besides accumulation of material wealth. They stimulate concentration (by individuals or groups) of relational wealth (Moreau 2020), based in network centralities, network extensions, reputation, and symbolism. Therefore, and returning to the title of this article, although in the context of preventive social strategies we might consider these communities were “digging for equality”, the prefix “(in)” expresses the social ambiguity of these investments.

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CHAPTER 9

Environment Matters



Figure chapter 9: The Nidda River Valley, Wetterau, Germany. Reconstructed landscape with the Late Neolithic Michelsberg settlement on the Altenburg hill near Randstadt-Dauernheim in the background (Drawing: Susanne Beyer; graphic: Petra Horstmann).

The Corded Ware Culture Settlement at the Jankowice 9 Site in Southeastern Poland

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KEYWORDS: Corded Ware Culture, settlement site, southeastern Poland

Abstract

The settlement at Jankowice, Site 9, in the Jarosław District, represents the first settlement of the Corded Ware Culture (CWC), which has been systematically excavated in the loess zone of Eastern Podkarpacie, Poland. Two settlement pits were discovered at the site. The first

pit yielded only fragments of animal bones, while the second contained an abundant collection of pottery fragments characteristic of the aforementioned culture. Both features were radiocarbon dated, and the pottery was also subjected to microscopic analysis.

Abstrakt

Osada w Jankowicach, stan. 9, pow. Jarosław jest pierwszym osiedlem ludności kultury ceramiki sznurowej badanym wykopaliskowo w strefie lessowej wschodniego Podkarpacia. Odkryto tam dwie jamy osadowe. W pierwszej z nich zarejestrowano jedynie fragmenty ko-

ści zwierzęcych, w drugiej stosunkowo liczne fragmenty ceramiki tej kultury. Oba obiekty datowano metodą radiowęglową a ceramikę dodatkowo poddano analizie mikroskopowej.

INTRODUCTION

The multicultural site no. 9 in Jankowice (Chłopice commune) is situated in southeastern Poland. It lies within the loess zone of the southern part of the Sandomierz Basin, within the boundaries of the Kańczuga Upland, according to Jerzy Kondracki's division (1978), or the Valley of the Lower San, according to the physiographic division by Jerzy Solon *et al.* (2018). The site encompasses the summit and the southern, eastern, and western slopes of the loess elevation, approximately 240 m above sea level (Fig. 1). Towards the south, the slope descends quite steeply towards the bottom of the valley, where a small unnamed stream flows (originating about 450 m from the site). Rescue excavations were conducted between 2009 and 2010 before the construction of the A4 motorway. The excavations were directed by Maciej Dębiec on behalf of the Rzeszów Archaeological Centre Foundation. A total area of 132.92 hectares was investigated, revealing numerous traces of settlement associated with several phases of habitation, namely the Corded Ware Culture

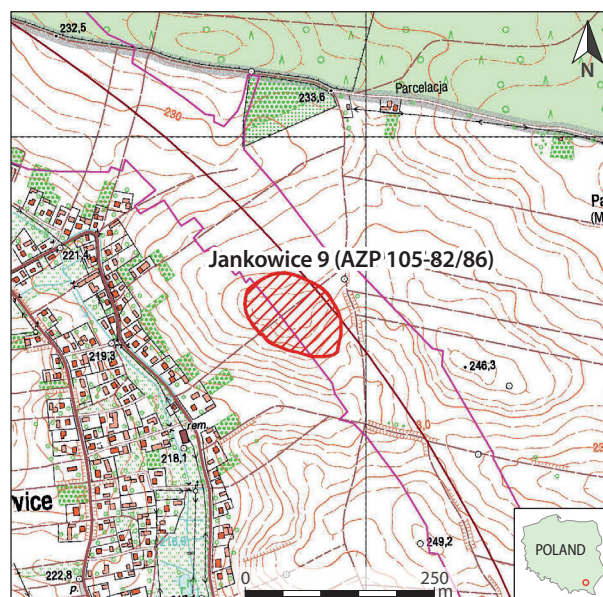


Fig. 1. Jankowice, site 9. The location of the site along with the delineation of the highway route (Graphic: Monika Dębiec).

(a longhouse), Funnel Beaker Culture (settlement features), Corded Ware Culture (settlement features), and Mierzanowice Culture (animal burial) (Dębiec *et al.* 2015). During the research, the northern, eastern, and western boundaries of the site were determined. Only towards the south does the site extend beyond the area

demarcated by the motorway. This area was geomagnetically surveyed, which allowed the full extent of the site to be recorded (Posselt and Saile 2015, figs. 2 and 3). This study focuses on settlement materials connected to the Corded Ware Culture (CWC).

THE MATERIALS

A total of 230 archaeological features were recorded during the archaeological excavations, two of which were associated with the CWC (Fig. 2). The cultural attribution of these features was determined based on specific criteria; in one instance, radiocarbon dating was used (feature 44), while in the other, ceramic analysis and a radiocarbon date were employed (feature 146).

Pit 44

This was identified at a depth of 40 cm counting from the ground surface. Its plan showed an oval shape with dimensions of 212×150 cm (Fig. 3), and its profile exhibited a hollow structure with a thickness of 83 cm from the identification level. The filling was heterogeneous. In the upper and central portions of the feature, it comprised a layer of grey (I) loess soil, containing animal bones and teeth. This layer was interspersed with strata of mixed greyish-yellow soil (II). The layer of grey (I) soil also occurred in the central part of the object's base. The remaining filling material consisted of brownish-greyish-yellow (III) loess soil. Within the pit, numerous animal bones belonging to *Bos taurus* (domestic cattle) individuals were recorded (the species identification of the animal bones was conducted by Danuta Makowicz-Poliszot (2015), along with a single unworked rock fragment.

Pit 146

This was demarcated at a depth of 40 cm from the ground surface. It was oval in plan with dimensions of 189×132 cm (Fig. 4), while in cross-section, it displayed a trapezoidal structure with a thickness of 131 cm. The filling material within the pit was heterogeneous, predominantly consisting of dark grey (I) loess soil, with layers of yellowish-grey (II) soil containing loess also present.

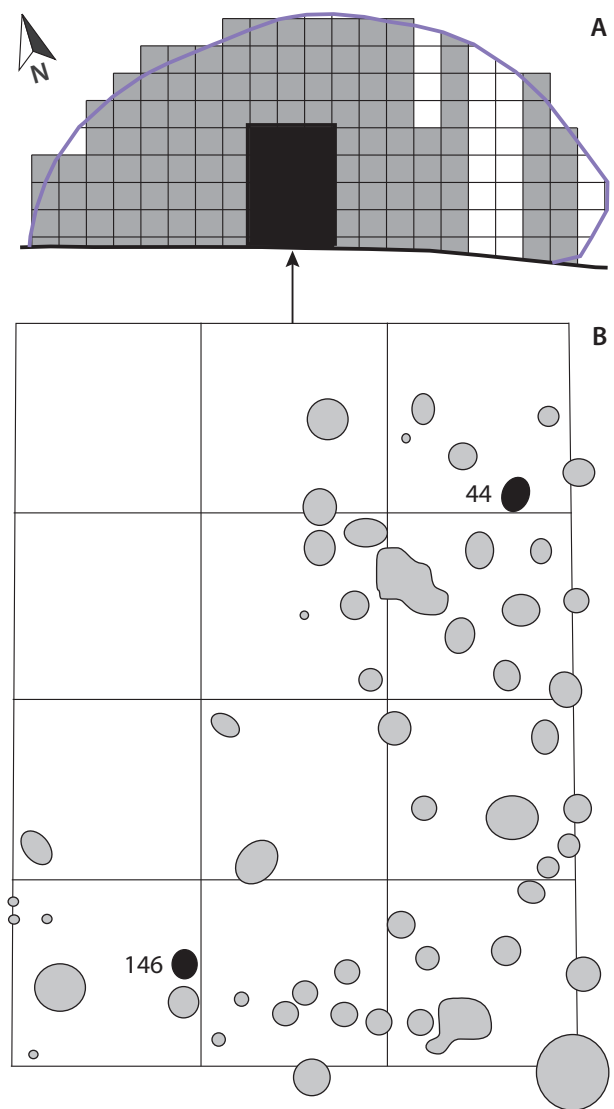


Fig. 2. Jankowice, site.9. A general plan of the examined part of the site with the grid. B enlargement of the site area with marked features 44 and 146 (Graphic: Monika Dębiec).

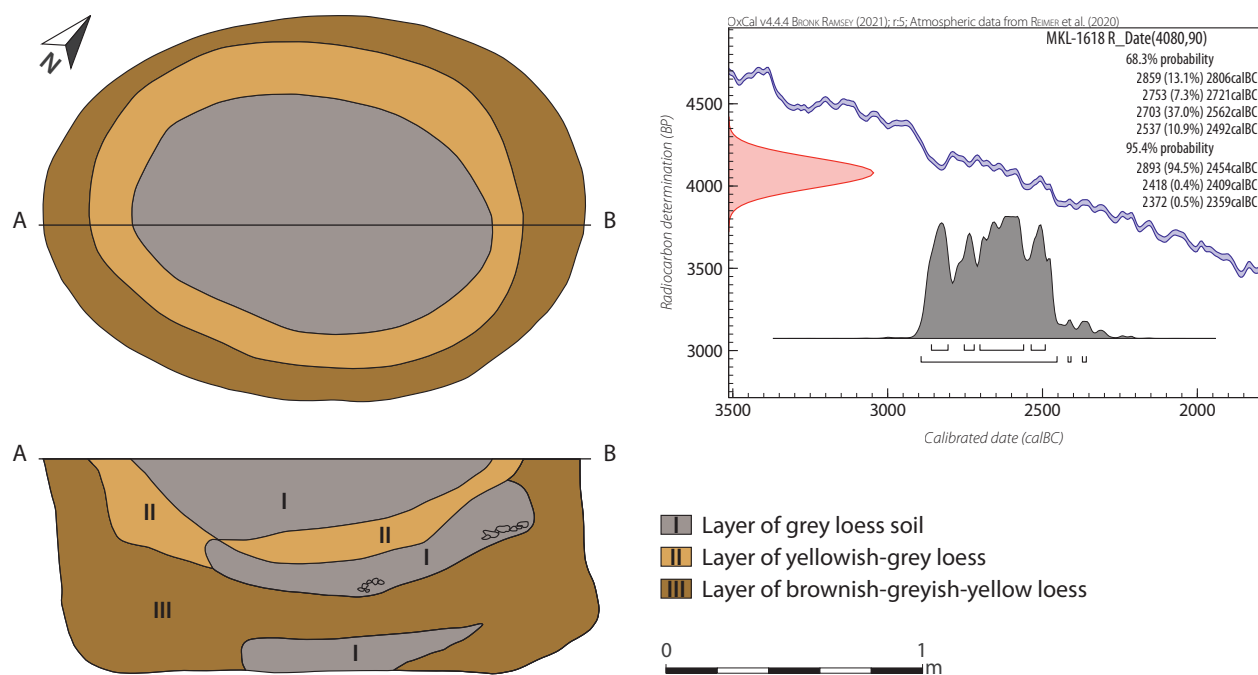


Fig. 3. Jankowice, site 9. Plan and cross-section of feature 44 and calibration of the ^{14}C date (Graphic: Monika Dębiec).

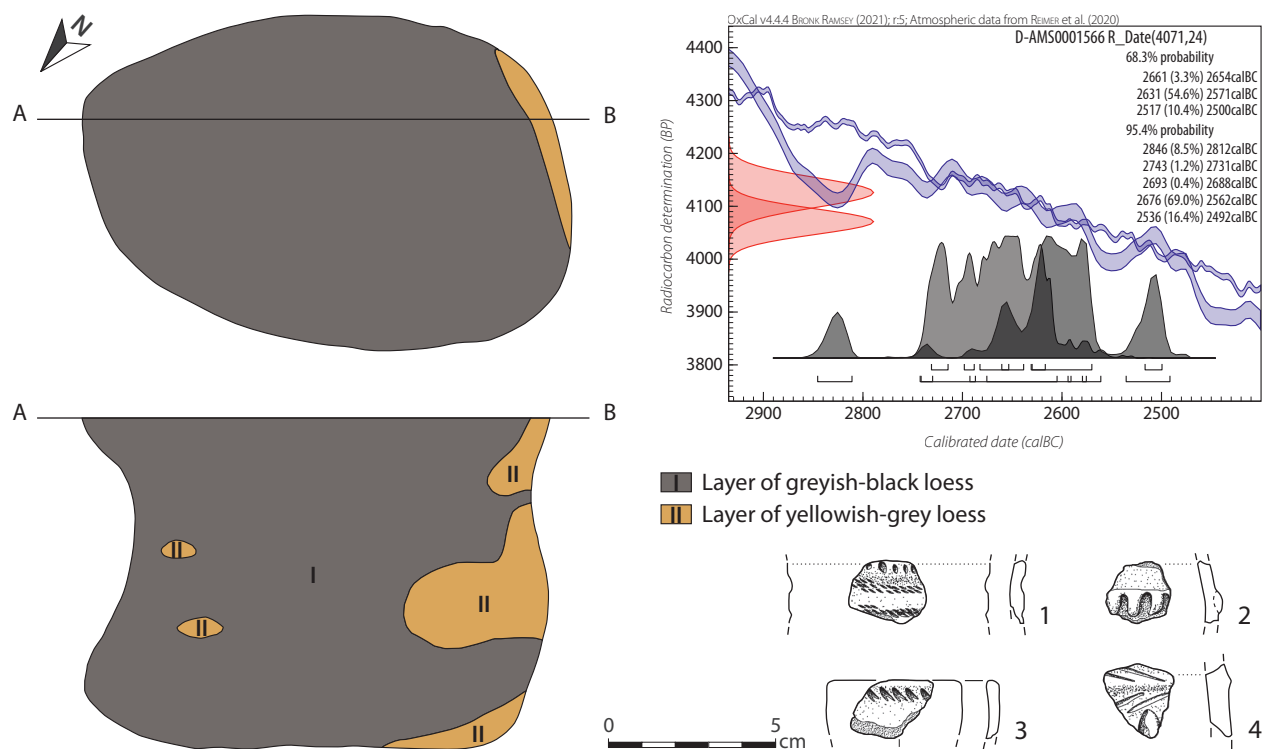


Fig. 4. Jankowice, site 9. Horizontal projection and profile of object 146, ceramics discovered in the filling of the pit, and calibration of the ^{14}C date (Graphic: Monika Dębiec).

Materials:**Depth 40–60 cm****Pottery of the Funnel Beaker Culture (FBC):**

1. Fragment of the vessel's body, with the largest dimension measuring 29 mm, thickness of 7 mm, uneven outer surface, a uniformly coloured break, compact layering, and a moderate admixture of sand temper.

Pottery of the CWC:

1. Fragment of the vessel's body with a two-strand cord ornament and a band of stamp impressions, largest dimension 23 mm, thickness 4 mm, damaged outer surface, uniform break, compact layering, no admixture (Fig. 4.1).
2. Fragment of the vessel's body with a strip decorated with impression ornamentation, largest dimension 20 mm, thickness 4 mm, uneven outer surface, uniform break, compact layering, no admixture (Fig. 4.2).
3. Fragment of a miniature vessel, maximum dimension 28 mm, rim diameter 4 cm, thickness of the side wall 3 mm, thickness of the rim part 3 mm, damaged outer surface, uniform break, compact layering, no admixture (Fig. 4.3).
4. Three fragments of the vessel's body, including one with pillar ornamentation, maximum dimensions: 20 mm, 23 mm, and 20 mm, thickness 5–6 mm, uneven outer surface, uniform break, compact layering, abundant admixture of ceramic grog with granulation up to 3 mm.
5. Two fragments of one vessel, including a fragment of a slightly everted rim, maximum dimensions 18 mm and 15 mm, thickness of the wall 6 mm, thickness of the rim 4 mm, uneven outer surface, uniform break, compact layering, a little temper of ceramic grog with granulation up to 2 mm.
6. Fragment of a straight bottom of a vessel, maximum dimension 46 mm, thickness 7 mm, thickness of the bottom 7 mm, smooth outer surface, uniform break, compact layering, not abundant admixture of ceramic grog with a grain size up to 2 mm.
7. Fragment of a flat bottom of a vessel, maximum dimension 40 mm, thickness of the wall 7 mm, thickness of the bottom 6 mm, damaged outer surface, sharp bichrome break, compact layering, abundant admixture of ceramic grog with a grain size up to 2 mm.
8. Two fragments of the body of one vessel, maximum dimensions 40 mm and 29 mm, thickness 6 mm, uneven outer surface, sharp bichrome break, compact layering, a moderate admixture of sand.

9. Three fragments of the body of one vessel, maximum dimensions: 78, 28 and 19 mm, thickness 6–7 mm, uneven outer surface, uniform break, compact layering, abundant admixture of ceramic grog with a grain size up to 2 mm.
10. Fragment of the vessel's body, maximum dimension 31 mm, thickness 12 mm, uneven outer surface, blurred bichrome break, compact layering, abundant admixture of organic material and ceramic grog with a grain size up to 2 mm.
11. Fragment of the vessel's body, maximum dimension 33 mm, thickness 6 mm, uneven outer surface, fuzzy bichrome break, compact layering, a moderate admixture of organic material and ceramic grog with a grain size up to 2 mm.
12. Fragment of the vessel's body, maximum dimension 31 mm, thickness 6 mm, uneven outer surface, sharp bichrome break, compact layering, a few grains of ceramic grog with a grain size up to 2 mm.
13. Fragment of the vessel's body, maximum dimension 22 mm, thickness 5 mm, uneven outer surface, uniform break, compact layering, a very abundant admixture of ceramic grog with a grain size up to 2 mm.
14. Two fragments of the body of one vessel, maximum dimensions 24 mm and 19 mm, thickness 7 mm, uneven outer surface, uniform break, compact layering, abundant admixture of ceramic grog with a grain size up to 2 mm.
15. Fragment of the vessel's body, maximum dimension 31 mm, thickness 7 mm, damaged outer surface, not sharp trichrome break, compact layering, abundant admixture of ceramic grit with a grain size up to 2 mm.
16. Fragment of daub.

Depth 60–80 cm**Pottery of the CWC:**

1. Fragment of the vessel's body, maximum dimension 29 mm, thickness 5 mm, uneven outer surface, uniform break, compact layering, no admixture.
2. Fragment of the vessel's body, maximum dimension 18 mm, thickness 6 mm, damaged outer surface, uniform break, compact layering, abundant admixture of ceramic grog with a grain size up to 3 mm.

Depth 80–100 cm**Pottery of the CWC:**

1. Fragment of the vessel's body, maximum dimension 14 mm, thickness 5 mm, uneven outer surface, fuzzy bichrome break, compact layering, abundant admixture of ceramic grog with a grain size up to 2 mm.

Stone artefacts:

1. Fragment of an unworked stone fragment, diameter 45 mm.

Depth 100–120 cm

Pottery of the CWC:

1. Fragment of the vessel's body with a herringbone ornament, maximum dimension 25 mm, thickness 6 mm, uneven outer surface, sharp trichrome break, compact layering, a moderate admixture of ceramic grog with a grain size up to 3 mm and crushed stones with a grain size up to 2 mm (Fig. 4.4).
2. Fragment of the vessel's body, maximum dimension 17 mm, thickness 6 mm, uneven outer surface, sharp trichrome break, compact layering, a moderate admixture of ceramic grog with a grain size up to 3 mm and crushed stones with a grain size up to 2 mm.

Stone artefacts:

1. Eight fragments of one stone object with traces of smoothing on two surfaces.

Depth 120–140 cm

Stone artefacts:

1. Fragment of an unworked stone fragment.

Depth 140–160 cm

Pottery of the CWC:

1. Two fragments of the body of one vessel, with the maximum dimensions of 22 mm and 13 mm, thickness of 5 mm, uneven outer surface, sharp trichrome break, compact layering, a moderate admixture of ceramic grog with a grain size up to 3 mm and crushed stones with a grain size up to 2 mm.

RADIOCARBON DATING

The dating of the CWC settlement pits from Jankowice, site 9, is based on radiocarbon dating. In the case of the pit designated as object no. 44, animal bones were dated, while object number 146 was dated using charcoal. For feature 44, a date of MKL-1618 4080 ± 90 BP (uncalibrated) was obtained, which, after

calibration with a 95.4% probability, falls within the range of 2900–2350 cal BC (Fig. 3). Regarding the feature labelled as no. 146, a date of ^{14}C : D-AMS0001566 4071 ± 24 BP (uncalibrated) was obtained, which, after calibration, falls within the range of 2850–2490 cal BC (Fig. 4) with a 95.4% probability.

Table 1. Grain fraction content; values expressed as volume percentages.

Symbol of the sample	Clay fraction $d < 0.002$ mm	Silt fraction 0.002–0.05 mm	Sand fraction 0.05–2.00 mm
Szn1	70	15	15
Szn2	74	13	13
Szn3	64	15	21
Szn4	65	17	18
Szn5	67	11	22

MICROSCOPIC ANALYSIS OF THE CWC CERAMICS

For analysis, fragments from five ceramic vessels of the Corded Ware Culture were allocated. These are small (2–7 cm) sherds found in feature 146. Due to the severe fragmentation, the shape of these vessels could not be determined. Selected fragments, based on macroscopic evaluation, were attributed to five different vessels. The fragments were marked with the symbol “Szn”, followed by a sequential order number. A thin polished section of each fragment was prepared for examination under a transmitted light-polarising microscope.

Through point-count quantitative microscopic analysis, the percentage composition of components, such as clay minerals, quartz, feldspar, mica minerals, heavy minerals, fragments of sedimentary, igneous, and metamorphic rocks, fragments of secondarily used ceramics, unmixed clay fragments, as well as organic material, was determined (Bolewski and Żabiński 1988; Quinn 2013, 190–203). Three primary grain size fractions were also distinguished: clay (< 0.002 mm), silt (0.002–0.050 mm), and sand (0.05–2.00 mm; Table 1).

The ceramic fabrics consist mainly of clay minerals (41.4–51.9%) and quartz silt (7.1–12.7%; Table 2). The clay matrix of the examined samples exhibits an orange-brown colour (Fig. 5). All samples show low content of feldspar minerals (up to 2% in sample Szn1) and heavy minerals (up to 0.3%). Coarser grains are mainly represented by quartz and feldspar, predominantly of the potassium variety. In two samples (Szn4 and Szn5), significant amounts of thermally altered glauconite (approximately 1%) were observed. The ceramic fabrics display numerous precipitates of iron oxides and hydroxides, as well as clayey clasts saturated with iron compounds. The clastic material is moderately rounded, and the quartz grains exhibit numerous cracks and inclusions. Sample Szn4 showed a slightly higher content of clastic material, primarily consisting of grains around 0.05–0.1 mm in size. Additionally, a presence of rounded quartz grains with a diameter of approximately 0.25 mm was noted.

The series of five examined samples shows a homogeneous and less diverse mineral composition. However, two samples (Szn4 and Szn5) were composed of clayey materials with a significant content of glauconite. The presence of this mineral is characteristic of marine sediment origins, a fact supported by data from the Kidałowice borehole, where Miocene marine sediments were encountered at a depth of 27 m (Kucharska and Piotrowska 2014). It cannot be ruled out that outcrops of Neogene sediments, including clays, might have been accessible to the CWC communities in river valleys.

The ceramic masses of the examined vessels are characterised by a clumpy structure, being poorly sorted and mixed. Deformations of the mass and impurities containing iron oxides are evident. Numerous voids, narrow longitudinal cracks resulting from dehydration and shrinkage of clay, as well as detachment of fragments from the previously fired clay, are visible within the vessel walls. Sample Szn1 exhibits the lowest void content at 2.6%, while sample Szn2 has the highest at 9.6% (Table 2). All fabrics contain fragments of secondarily used ceramics. The content of the three basic grain size fractions (clay-silt-sand) is similar in all samples (Table 1).

The main temper introduced during clay preparation is grog (secondarily used ceramics). It is characterised by diversity in both shapes and sizes, as well as colours. The masses contain both small (approximately 0.1 mm) and large (>1.0 mm) grog particles. Sample Szn2 has the highest content of 28.6%. In the remaining samples, the grog content ranges from a few to several percent. The orientation of narrow cracks within these particles often does not align with the direction of cracks in the ceramic mass in which they are embedded. Older fragments of the ceramics are visible in some grog particles.

Table 2. Mineral composition; values expressed as volume percentages.

	Voids	2.60	9.60	6.80	9.30	6.90
	Others			0.30	0.60	0.60
	Heavy minerals	0.20		0.20	0.40	0.30
	Organic fragments					
	Clay pellet	12.40	1.40	1.90	0.90	6.70
	Grog	7.00	28.60	12.60	10.60	4.90
	Iron compounds	1.60	4.00	2.70	0.90	1.40
	Opaque minerals	0.30	0.40	0.30	1.20	0.90
	Biotite					
	Muscovite	2.00	0.00	0.00	1.80	1.20
	Fragments of metamorphic rocks			0.30		
	Fragments of igneous rocks					
	Fragments of sedimentary rocks					
	Feldspars	1.00	0.40	2.70	2.10	4.10
	Quartz	9.80	7.10	12.60	11.50	13.00
	Grains of silt fraction (0.002–0.050 mm)	11.70	7.10	11.30	12.70	8.10
	Clay minerals	51.40	41.40	48.30	48.00	51.90
Symbol of the sample	Szn1					
	Szn2					
	Szn3					
	Szn4					
	Szn5					

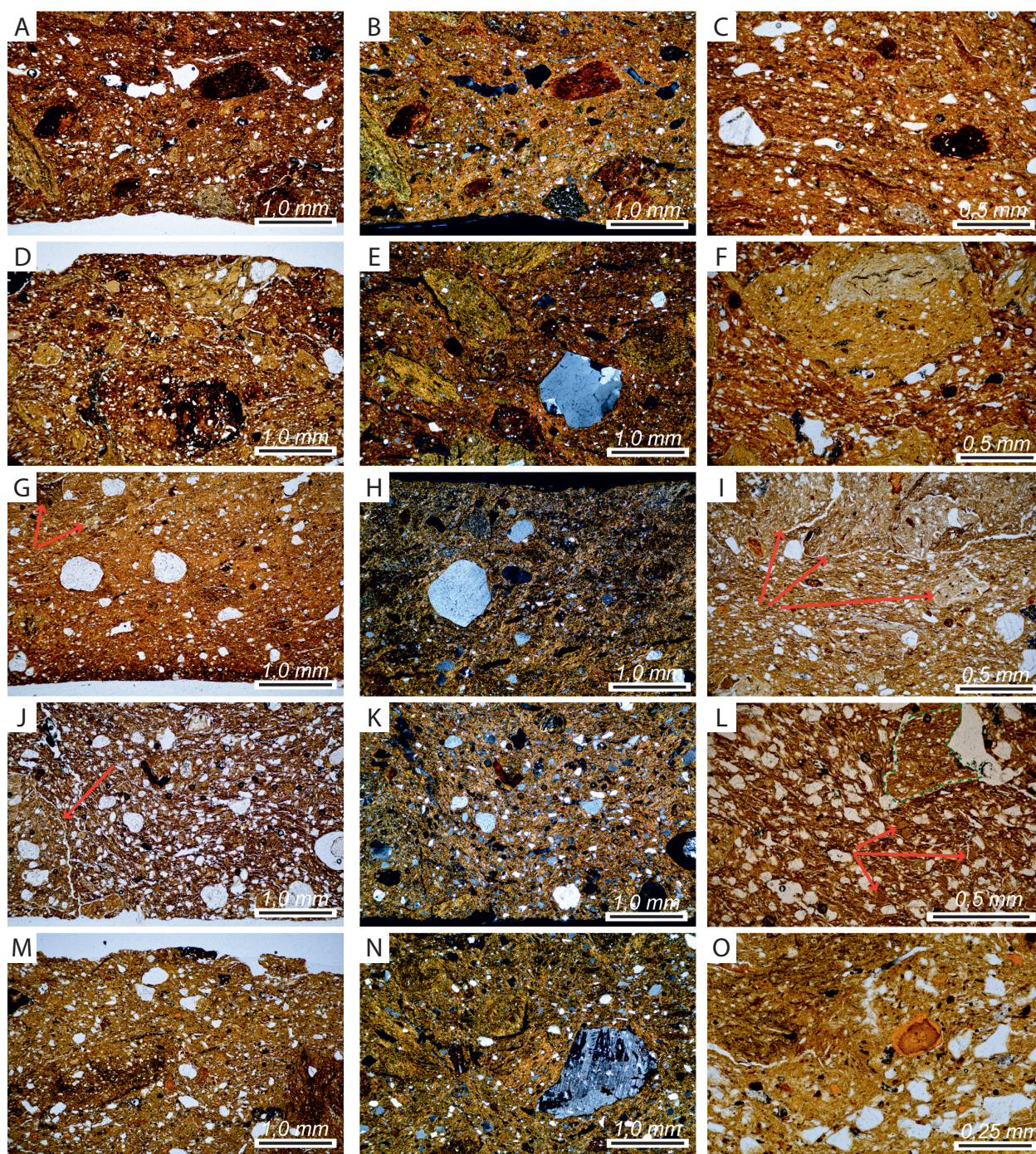


Fig. 5. Jankowice Site 9. Photomicrographs of CWC ceramics. A, B, C Sample Szn1 ; D, E, F Sample Szn2; G, H, I Sample Szn3; J, K, L Sample Szn4; M, N, O Sample Szn5; A, B, inner surface, visible bright yellow grog particles and dark orange clasts of ferruginous clay, numerous fissures visible in the centre; A PPL, B XPL; C interior of the vessel wall, visible orientation of ceramic fabric – parallel bands of ferruginous precipitates, PPL; D outer surface, numerous yellowish grog particles visible, a grog fragment near the surface containing older ceramic fragments, a concentration of iron compounds (slightly to the right at the bottom), PPL; E interior of vessel wall, yellowish grog particles and angular quartz grain visible, XPL; F interior of the vessel wall, grog particle, PPL; G outer surface, a few rounded quartz grains in a fine-grained fabric, small fragments of grog are indicated by arrows, PPL; H inner surface of the vessel wall, slightly to the left in the centre, a grain of rounded quartz, XPL; I interior of the vessel wall, numerous grog particles (arrows), PPL; J, K outer surface of vessel, numerous rounded quartz grains and grog particle (arrow), J: PPL, K: XPL; L interior of the vessel wall, numerous grains of thermally altered glauconite visible in the ceramic fabric (arrows), a grog fragment at the top right (dashed line), PPL; M outer surface of vessel, orange glauconite grains (in the centre) and clasts of unmixed clay, PPL; N interior of the vessel wall, partially altered feldspar grain, XPL; O interior of the vessel wall, orange glauconite grain, a grog fragment at the top left, PPL (Photos and graphic: Anna Rauba-Bukowska).

The addition of sand cannot be definitively confirmed. Rounded grains present in the ceramic masses may be a natural component of the clay. Larger amounts of sand are only observed in sample Szn4. Rel-

atively small amounts of the silt fraction suggest that loess sediments were not added to the ceramic masses. No organic impurities were detected in the fabrics.

INTERPRETATION OF THE ANALYSIS

The manufacture of the vessels examined involved the use of relatively heavy clays with a low proportion of poorly sorted clastic material. These clays were probably available in river valleys. The raw material was mixed with a temper, primarily consisting of ceramic fragments, and the fragments were not selectively chosen, displaying considerable diversity. No addition of loess was detected, and rounded grains (sand) could be a natural component of the applied raw materials. Numerous narrow cracks and oriented micro-laminations suggest significant shrinkage of the clay material, especially in samples Szn2 and Szn4, but also in Szn3 and Szn5. This could be a result of an overly wet clay mix. The masses are moderately worked, and the non-plastic inclusions (crushed stone and grog) are evenly distributed in the matrix. The firing temperature was

tentatively determined, based on the thermal alteration of clay minerals (Stoch 1974, 484; Quinn 2013, 190–203; Whitbread 2016; Daszkiewicz and Maritan 2016; Czekał-Zastawny *et al.* 2021, 109). No vitrification (glassing) effect was observed, suggesting a relatively low firing temperature (approximately 750°C). The orange hues of the break surfaces of samples Szn1, Szn2, and Szn4 indicate air influx during the firing process. Two samples, Szn3 and Szn4, were fired with limited air supply. Sample Szn3 is oxidised only on the exterior, while Szn4 is uniformly grey brown. On the basis of the research carried out, it can be concluded that the vessels examined were made using similar technology (temper, working method, firing) and from similar raw materials.

MATERIAL FROM JANKOWICE IN THE CONTEXT OF OTHER ANALYSES OF CWC CERAMICS

According to the technological classification established for the southeastern regions of Poland (Rauba-Bukowska and Bukowski 2022), the ceramic fragments from Jankowice, in the context of the Corded Ware Culture, predominantly represent Type B (samples Szn1, Szn2, Szn3, and Szn5). This type is characterised by the use of clayey loams and the addition of grog, i.e., fragments of older ceramics. The content of sand (whether natural or intentionally added) in such masses is minimal. Vessels other than beakers, such as amphorae, were more commonly crafted from these materials. Sample Szn4, due to its grog content and higher sand content, can be classified as Type A. It can be referred to as “beaker-like” due to the microscopic analysis of Corded Ware vessels, where beakers are more frequently made from mixtures of grog and sand

(Rauba-Bukowska 2011, 573–629, fig 9; Rauba-Bukowska and Bukowski 2022, table 4). Furthermore, at the Święte site (Jarosław district), a correlation was observed between Type A ceramic mass and corded ornamentation (Rauba-Bukowska 2018). As previously mentioned, the ceramic materials from Jankowice are too fragmented to accurately classify them into forms or determine ornamentation type (Rauba-Bukowska 2015). Additionally, it should be noted that materials from Jankowice are among the few originating from settlement sites, whereas the majority of microscopically examined CWC vessels from Polish sites were discovered in funerary contexts. Currently, the issue of differences or their absence between vessels found in settlements and those in burial contexts cannot be explained.

SUMMARY

At Jankowice, site 9, two settlement features of the Corded Ware Culture were discovered, dug in the loess bedrock. Both exhibited similar shapes and dimensions, situated approximately 30 m apart from each other at the highest part of the site, which concurrently represents the culmination of a loess hill. The settlement character of these pits is beyond doubt.

However, each of them contained a distinct assemblage of artefacts, suggesting potential variations in their respective functions. In the first case, animal bones were present, with a complete absence of ceramics, while in the second case, numerous albeit small fragments of clay vessels were found in the absence of bones.

The pottery fragments found are so small that it is not possible to make any general statements about the size and shape of the vessels. The pottery is technologically uniform. The exposed sherds are up to 6 mm thick, with finely crushed pottery being the most common tempering material, and sand more rarely used. Surfaces are damaged, making it impossible to determine the original treatment of vessel walls.

Radiocarbon dates obtained from both features, although derived from different types of organic material, are similar. The slight distance between the objects and the comparable radiocarbon dates may suggest that they are remnants of a single settlement. However, one cannot rule out a slight temporal variation.

Settlements of the Corded Ware culture, although still relatively scarce, are increasingly being discovered in this part of Europe (Witkowska 2006, fig. 1). They were previously documented in various locations, including caves in the Kraków-Częstochowa Upland (Rook 1980, 55), and in recent decades, as part of extensive rescue excavations associated with highway construction: Kraków-Rząka, site 1; Kraków-Bieżanów,

site 27; Kraków-Kurdwanów, site 12 (Włodarczak 2002, 5); Kłaj, site 34, and Stanisławice, site 9 (Czekaj-Zastawny *et al.* 2002; 2003, 294, 295; Jarosz 2015). In the upper part of the San River basin, settlement materials of this culture were recorded in Przybówka (Gancarski 1992). Among the Carpathians, noteworthy are the materials from Czchów (Madej and Valde-Nowak 1997–1998) and from the Ondava Upland in Slovakia (Valde-Nowak 1994; 1997; 2001; Valde-Nowak and Strakošová 2001). In the upper part of the Dniester River basin, perhaps the oldest settlement of the Corded Ware Culture in the Carpathian zone is located in Side, Ukraine (Machnik *et al.* 1997). The peculiarity of the CWC material from Site 9 at Jankowice lies in the presence of dug features, suggesting the existence of a relatively permanent settlement by the population of this culture. However, these findings do not alter the overall picture of the economy, social organisation and lifestyle of the Corded Ware Culture, which was based on animal husbandry and a nomadic lifestyle (Machnik 2004).

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Salt – Nutrition and Wealth in the Central European Neolithic

Walter Dörfler

KEYWORDS: salt, nutrition, Neolithic, jadeite, spondylus, wealth

Abstract

Sodium is an essential element of human nutrition. Its content is much higher in animal products (meat, blood or milk) than in plant products. To fulfil the physiological requirements of 550 mg Na/day, humans have to either consume a large amount of animal products (more than 50% of their calorie intake) or use external sources of sodium in the form of salt (sodium chloride).

Neolithisation was accompanied by a change in diet towards more plant products, and in particular cereals. Thus, the availability of salt became more important and access to this resource was crucial. To reconstruct the natural distribution of salt springs, two methods are applied: Before deep drilling became possible in 1817, saltworks were dependent on springs with brine. A distribution map of historical saltworks

allows for the identification of areas with and without access to salt in surface water. The second method is a mapping of salt plants (halophytes) in Germany that show good correspondence with the saltworks. They are compared to the distribution of early Neolithic settlements and also to the distribution of indicators of wealth: jadeite axes and Spondylus jewellery. Even though there is a big overlap, there is no proof of a correlation between salt and wealth in the Neolithic in the area of modern Germany. As salt production can be practiced without briquetting and brine can also be used for curing meat or be transported in animal bladders or stomachs, evidence of Neolithic salt consumption and trade is nearly impossible. Thus, attention should be paid to indirect indications of a connection between salt and wealth.

Zusammenfassung

Natrium ist ein essentieller Bestandteil der menschlichen Ernährung. Sein Gehalt ist in tierischen Produkten (Fleisch, Blut oder Milch) deutlich höher als in pflanzlichen. Um den physiologischen Bedarf von 550 mg Na/Tag zu decken, muss der Mensch entweder große Mengen tierischer Produkte (mehr als 50% seiner Kalorienzufuhr) zu sich nehmen oder auf externe Natriumquellen in Form von Salz (Natriumchlorid) zurückgreifen. Die Neolithisierung ging mit einer Ernährungsumstellung hin zu mehr pflanzlichen Produkten, insbesondere Getreide, einher. Dadurch gewann die Verfügbarkeit von Salz an Bedeutung und der Zugang zu dieser Ressource war entscheidend. Zur Rekonstruktion der natürlichen Verteilung von Salzquellen werden zwei Methoden angewendet: Bevor 1817 Tiefbohrungen möglich wurden, waren Salinen auf Quellen mit Sole angewiesen. Eine Verbreitungskarte historischer Salinen ermöglicht so die Identifizierung

von Gebieten mit und ohne Zugang zu Salz in Oberflächen-nahen Gewässern. Die zweite Methode ist eine Kartierung von Salzpflanzen (Halophyten) im Gebiet Deutschlands, die eine gute Übereinstimmung mit den Salinen aufweist. Beide Karten werden mit der Verteilung frühneolithischer Siedlungen sowie mit der Verteilung von Wohlstandsindikatoren verglichen: Jadeitäxten und Spondylus-Schmuck. Trotz großer Überschneidungen gibt es für das Neolithikum im Gebiet des heutigen Deutschlands keinen Beleg für einen Zusammenhang zwischen Salz und Wohlstand. Da die Salzgewinnung ohne Briquettagung erfolgen kann und Sole auch zum Pökeln von Fleisch verwendet oder in Tierblasen oder -mägen transportiert worden sein kann, ist ein Nachweis für neolithischen Salzkonsum und -handel nahezu unmöglich. Daher sollten indirekte Hinweise auf einen Zusammenhang zwischen Salz und Wohlstand beachtet werden.

INTRODUCTION

Social inequality requires a certain degree of prosperity or surplus production. If the economy just allows a basic subsistence, prestige goods are hardly obtainable. With the transformation of a Mesolithic to the Neolithic way of life, humans were enabled to accumulate wealth and establish an exchange or trade with prestige goods (Müller et al 1996). Agriculture, including arable farming and animal husbandry, became the basis for population growth but this was accompanied by new dependencies. A suitable climate and the availability of resources were preconditions for the residential lifestyle. The first farmers north of the alp chose good soils as one important resource for the production of cereals, meat and milk. Another resource is often overlooked: The availability of salt or Sodium chloride (NaCl) is a crucial point in human nutrition (Elmadfa and Leitzman 2023). In the reconstruction of food resources for prehistoric times salt is often not taken into account. Such reconstructions

deal with different approaches: Studies of plant macro remains and animal bones from excavations are one agent, the analysis of N- and C-isotopes from bones and teeth is another, and the study on dental abrasion is a further method. Another approach, followed in this paper, deals with the nutritional requirements of human diet, especially the need for sodium but also for other trace elements, minerals and vitamins. To meet this requirement, humans rely on sodium intake, either through normal diet or in form of salt, added to food. This study evaluates the distribution of historic salt springs in Germany, where brine potentially was accessible for humans in prehistory.

As the availability of salt is often associated with wealth (Stöllner 2007; Nikolov and Bacvarov 2012; Harding 2021), additionally the distribution of wealth indicators in the Neolithic, in particular *Spondylus* and Jadeite, is discussed in relation to the distribution of salt springs.

CONDITIONS OF HUMAN NUTRITION

Foodstuffs are based on a fan of components. There are carbohydrates and fats as energy suppliers and proteins as building blocks of organic matter but also as energy supplier. Additionally, vitamins, minerals, and trace elements are essential for metabolism. The availability of water is a further condition for human life.

The need for energy can be fulfilled with food from plant- as well as from animal-origin. As the requirement varies strongly according to age and activity (Elmadfa and Leitzmann 2023) an average value of 2400 kcal per day and person can be calculated (Dörfler 2012). Short phases of malnutrition may be overcome by body fat but constant hunger leads to permanent weakening and damage of the body. Like for carbohydrates, the same regards for the need of all other components like proteins, vitamins, minerals and trace elements. In a study from the 1980ies, the daily intake of proteins varied globally in a wide range from 6,3 g to 70,7 g per person for animal sources and from 27,5g to 42,5 g for plant sources (Fig. 1). South-Asia and North America are representing the two extremes at this time (Leitzmann 1983). The range of values shows the flexibility of the human digestive system.

Drinking water, as an obvious precondition for human settlement, is often taken into account when reconstructing settlement patterns. But the availability of minerals, trace elements and vitamins is often overlooked when reconstructing human living conditions in prehistory. It is not only the quantity but also the quality and variability of food that determines a

person's health. Vitamins, for instance, are supplied with plant and animal products (Elmadfa and Leitzmann 2023). With a balanced diet the supply is covered but unbalanced nutrition in cases of plant or animal disease may have caused health problems due to lack of specific vitamins. Famous is the historic occurrence of scurvy in crews of sailing ships because of Vitamin C deficiency.

Like vitamins, minerals and trace elements are not equally present in food components. The minerals include the elements calcium, potassium, chlorine, sodium, magnesium, phosphorus, and sulfur. Other, more rare chemical elements are called trace elements. Iodine, as example, is an element that is rare in soils and groundwater of humid areas and Iodine deficiency in historic times was a widespread disease, particularly in the Alpine regions (Fuge 1996; De Vos and Tarvainen 2006). Until the 1920ies, when Iodine became added to salt, Goiter formation and cretinism was a common phenomenon in alpine valleys.

Regarding the minerals, Calcium is important for bone formation and the transmission of stimuli in the nervous system (need for an adult approx. 1000 mg/d), potassium regulates the osmotic pressure of the body's cells and metabolism (required approx. 4000 mg/d), chlorine is used to generate hydrochloric acid for digestion and also for regulation the osmotic pressure it is necessary (requirement 2300 mg/d). Magnesium plays a role in enzyme activation (requirement 300 to 500 mg/d) and phosphorus in building bones and is a

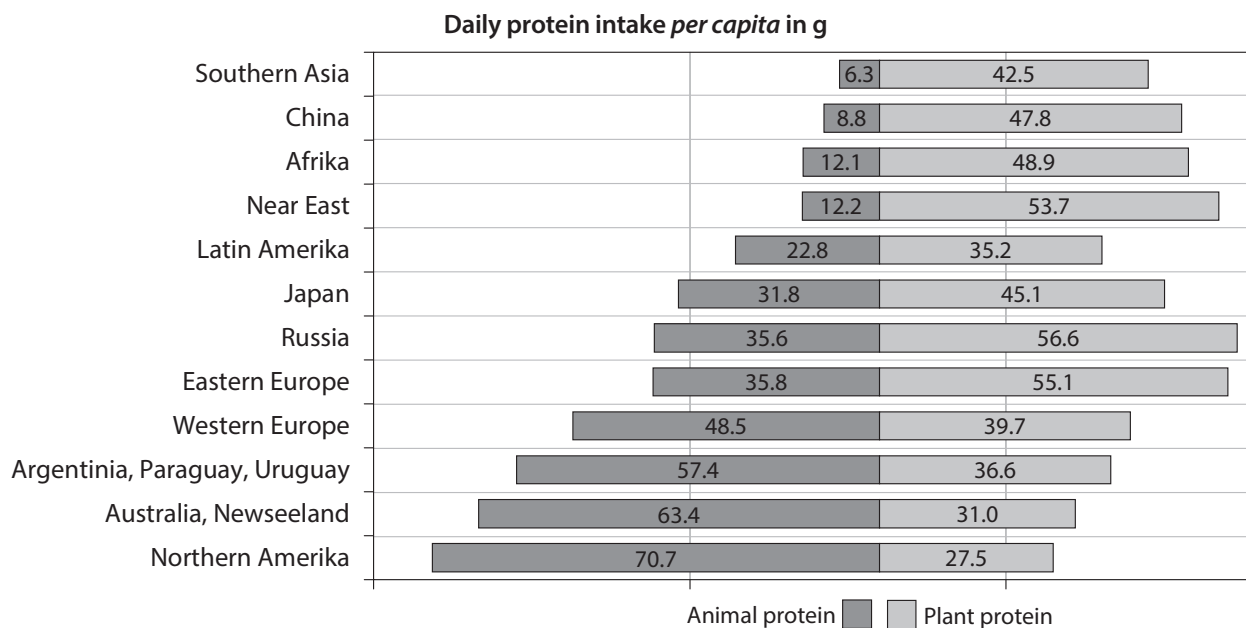


Fig. 1. Relation of protein intake of animal and plant origin in different regions in the 1980ies (from Dörfler 2012, after Leitzmann 1983).

component of energy-transmitting enzymes (requirements 800 to 1200 mg/d). Sulfur also is needed as element of bone building and protein synthesis and has many functions in metabolic processes (data based on Elmadfa and Leitzman 2023).

The role of sodium in human nutrition

Sodium is responsible for the osmotic pressure in the Extracellular space. Data about daily requirement for sodium vary strongly: In 1983 Claus Leitzmann wrote that 1–3 g NaCl is the daily requirement, equivalent to 400 to 1200 mg Sodium per day. In the 7th edition of Ibrahim Elmadfa and Claus Leitzmann from 2023 a reference value of 1500 mg/d for an adult person is given. According to the recommendations of the German Nutrition Society (DGE) the minimum daily sodium intake is estimated at 550 mg; this amount corresponds to a salt intake of 1.4 g (DASCH 2000). These values represent the minimum input recommendations. Due to food preparation and conservation the actual input is much higher. Nowadays sodium is added as flavour enhancer to many products and it is difficult to implement a low-salt diet. The estimated global average of recent sodium intake is 3660 to 4000 mg/day (McCarron *et al.* 2013; Elliott and Brown 2007).

The most often given value of 550 mg Na or 1,4 g NaCl per person and day as minimum supply seems to be an estimate. In contradiction to this value, a study on blood pressure on Yanomamo Indians (Brazil and

Venezuela) reports a “no-salt” culture (Oliver *et al.* 1975). Measurements in blood serum show high values in renin and aldosterone values. Both hormones regulate the Na retention and excretion by the kidneys. Accordingly, the Na-content in urine of the Yanomami people was extremely low in relation to other populations with excess to salt. The Yanomami nutrition was based at the time of this study (1960ies and 70ies) mainly on cooking banana, “supplemented by irregular additions of game, insects, and wild vegetable foods. The tribe has had no access to sodium chloride except where the substance has been introduced” (Oliver *et al.* 1975). The urinal Na⁺ excretion of Yanomami people, also studied in a big INTERSALT Study (Mancilha-Carvalho and Albuquerque de Souza e Silva 2003; Brown *et al.* 2009) was the lowest worldwide with about 1 mmol/d (23 mg/d). This would be just 1/20 of the recommended minimum input value of 550 mg Na/d. Excretion by feces or sweat are not included in this study. Other isolated populations (Indians from Xingu, rural population of Kenya and rural population of Papua, New Guinea) also had low Na⁺ excretion between 6 and 51 mmol/d. This is equivalent with 138 to 1173 mg Na/d, what is still low in comparison to the modern average value of 3680 mg/d (165 mmol/d) of 48 other populations in this study (Mancilha-Carvalho and Albuquerque de Souza e Silva 2003).

Thus, humans may survive with low sodium intake but the hormonal status has to be adopted and the physiologically determined appetite for salt forces humans to choose foods containing sodium. The hunger

for salt, which is controlled by hormones, ensures an adequate supply of the vital trace element in order to avoid the symptoms of sodium deficiency (Hyponatremia). These symptoms consist of brain dysfunction. At first people become sluggish and confused, and as the sodium deficiency worsens, they experience muscle tremors and seizures.

Just as the content of carbohydrates, fat and proteins varies between plant and meat foods, it also varies greatly within these groups. The same applies in

particular to the sodium content. In Table 1 the values of different food components are summarised according to Siegfried Walter Souci *et al.* (2008). Apart from carrot (62 mg/100 g), linseeds (60 mg/100 g) and barley (18 mg/100 g) all plants and plant parts have a sodium content of less than 10 mg/100 g. Meat and other animal products, on the other hand, have values around 50 mg/100 g (milk, flesh) or even 116 mg/100 g (beef liver) or 330 mg/100 g (blood). Eggs have a value of 144 mg/100 g (Souci *et al.* 2008).

Table 1. Content of components in selected foodstuffs (Source: Souci *et al.* 2008).

Foodstuff	Karbo-hydrates [g/100 g]	Protein [g/100 g]	Fat [g/100 g]	Sodium [mg/100 g]	Calorific value [kcal/100 g]
Beef	0.11	18.60–22.00	1.90–14.00	49.00–66.00	108–200
Cattle blood		17.80	0.13	330.00	74
Cattle liver	5.30	19.20	3.66	116.00	132
Pork		17.50–22.00	1.80–21.10	59.00–74.00	106–260
Bacon		4.10	82.50	21.00	749
Mutton		14.90–20.40	3.40–37.00	75.00–118.00	113–378
Eg (whole)	0.70	12.50	11.40	144.00	155
Fish, freshwater		15.00–19.90	0.85–24.50	60.00–75.00	83–279
Fish, saltwater		17.70–18.20	0.70–17.80	72.00–117.00	78–232
Oyster	4.80	9.00	1.00	160.00	67
Cow milk	4.70	3.30	3.80	48.00	67
Sheep milk	4.70	5.30	6.00	51.00	94
Cow-butter		0.70	83.20	5.10	742
Hazelnuts	10.50	12.00	61.60	2.00	639
Pea	13.30	6.55	0.48	2.00	82
Carrot	4.80	0.98	0.20	62.00	26
Appel	11.40	0.34	0.60	1.20	55
Barley, dehusked	69.30	11.20	2.10	18.00	319
Wheat	59.60	11.40	1.80	7.70	303
Spelt, dehusked	60.30	17.00	1.70	0.55	325
Oat	55.70	10.70	7.10	8.40	331
Rye	60.70	9.50	1.70	3.80	299
Buckweat	71.00	9.77	1.73	2.00	342
Linseed	29.00	28.80	30.90	60.00	376

In consequence, to fulfil the need for sodium, if no external source of salt is available, plant products can be just one component of human nutrition. Animal products can compensate this deficiency, not only to fulfil the need for proteins but mainly also to satisfy the hunger for salt. A calculation with average values

of 6 mg Na/100 g for cereals and 2 mg Na/100 g for pulses (pea) and 80 mg Na/100 g for animal products shows that at least 50% of the nutrition must originate from animal products to fulfil the requirement of 2400 kcal and 550 mg Na (Dörfler 2012).

EXAMPLES FOR QUANTITATIVE ESTIMATES OF FOODSTUFFS BY ISOTOPE STUDIES OF HUMAN BONES

Since isotope analyses became standard in studies of archaeological bones (e.g. Schwarcz and Schoeninger 1991; Tieszen 1991; Ambrose 1993), a growing body of data is available for the reconstruction of the nutrition of humans and animals in prehistory (e.g. Oelze *et al.* 2011; Marciniak *et al.* 2017; Gron *et al.* 2024). Apart from single burials or cemeteries, also regional or chronological reviews of the data are published (e.g. Münster *et al.* 2018; Bickle 2018; Drtikolová Káupová *et al.* 2023). Due to the application of the Bayesian modelling software FRUITS (Food reconstruction Using Isotopic Transferred Signals, Fernandes *et al.* 2012, 2014), also quantitative estimates of food stuffs like salt- or freshwater fish, meat or dairy products, cereals and other plants have been carried out (e.g. Fernandes *et al.* 2015; Bownes *et al.* 2017; Bickle 2018). It is important to say that these estimates are based on a statistical approach with uncertainties depending on the components and data included in the model (see also Bickle 2018). The results should be used with care as an uncritical application of the FRUITS software can give misleading results (Schulting *et al.* 2023).

Penny Bickle (2018), who analysed and interpreted C- and N-isotope values from Mesolithic as well as Neolithic (*Linearbandkeramik* [LBK]) individuals from Central Europe found no general typical pattern

in isotope composition either in Mesolithic or in Neolithic (LBK) populations. Instead, a “quiet diverse pattern may have been the norm” (Bickle 2018). She modelled her data by FRUITS (Fernandes *et al.* 2014). The model shows a reduction of the proportion of terrestrial animals in the diet from the Meso- to the Neolithic by 15 %. But she mentions that these results must be handled cautiously. The percentage of meat versus milk in the diet influences the results as well as manuring may cause a shift in the cereal isotopic stage and make interpretation problematic. The consumption of pulses is a further factor that influences the Nitrogen isotopic values of bones or teeth. Thus, the modelling allows for an estimate of foodstuffs but not for a quantitative reconstruction.

Not going into details of these studies, it is obvious that the degree of plants in human nutrition, in particular cereals, increased strongly during the neolithisation. As an area used by arable farming can produce much more calories suitable for human nutrition as the same area used by hunters and gatherers, the economic transformation enabled an unprecedented growth of population (Dörfler 2022). The higher plants and in particular cereals are components of human nutrition, the higher is the need for external sources of salt as the content of sodium in plants is very low (see above).

THE AVAILABILITY OF SODIUM IN DIFFERENT REGIONS OF MODERN GERMANY

Since humans depend on the intake of sodium as component of their daily diet, the question arises how this need was met in historic and prehistoric times, when salt was a rare and expensive commodity (Saile 2000; Saile 2008; Weller 2002; Bánffy 2015). This is especially true in times when grain became the main diet.

Although Na is the most abundant alkali metal and the sixth most abundant element in the Earth's crust with 22,7 g/kg in average (Wedepohl 1995), its occurrence in soils differs strongly. Its frequency depends on the bedrock material and distance to the sea (De Vos *et al.* 2006). The today distribution of Na⁺ in stream water is shown in figure 2. Just a few regions show values above 21 mg/l. As the daily minimum need for sodium is said to be 200 to 500 mg per person, it is clear that this cannot be covered by drinking water alone.

Along the coasts, seawater is and was an easily accessible source of salt but inland the access to brine or rock-salt depends on geological and hydrological conditions and its distribution is uneven. In central Europe rock salt appears in form of salt veins in the alps (e.g. Hallstatt and Hallein, Austria) and Carpathians (e.g. Wieliczka and Bochnia, Poland) or in other

regions where tectonic activity has pushed salt veins close to the surface (e.g. Halle/Saale) and where brine sprigs appear or where thermal water transports brine from deeper layers to the surface (e.g. Bad Nauheim and Wiesbaden, Germany). In the German lowlands salt domes are the precondition of brine. Due to tectonic processes, rock salt, that has a low density and low strength can ‘flow’ and penetrate near the surface under the pressure of overlying rocks or glaciers. Where groundwater gets into contact, salt can be dissolved from such salt domes and reach the surface in form of brine springs (e.g. Lüneburg and Bad Oldesloe, Germany). Figure 3 shows the distribution of such salt domes in the Northern German lowland.

In the case of Arendsee the salt dome was dissolved by groundwater and a lake was formed as a sinkhole or doline. Salt domes are restricted to northern Germany to the area covered by ice during the Pleistocene, i.e. the moraine region. Although salt domes are widespread in the subsoil of northern Germany, there are only a few locations where salty groundwater reaches the surface and where saltworks were founded.

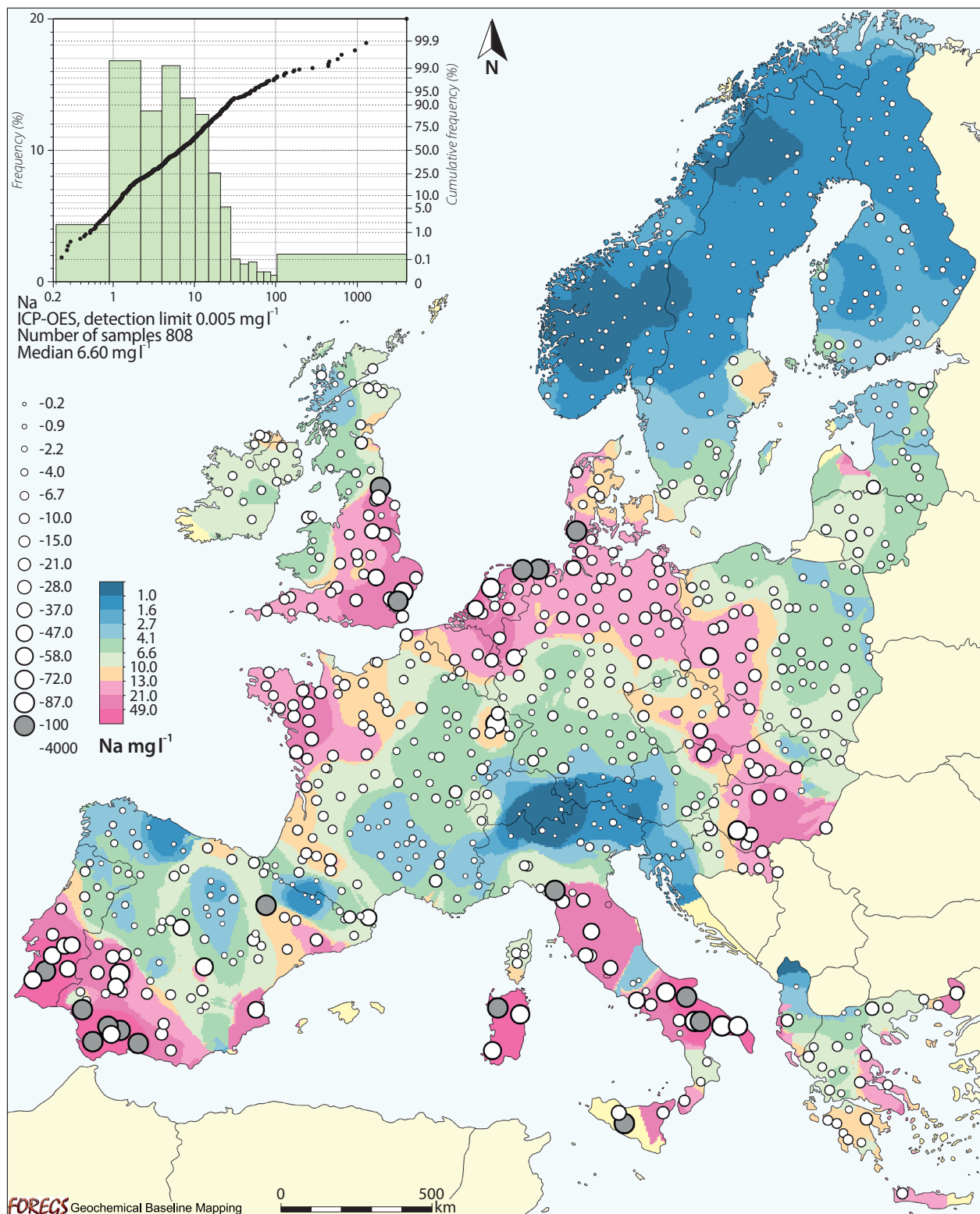


Fig. 2. Sodium in Streamwater in Western and central Europe (after Salminen et al. 2005).

All prehistoric and historic saltworks were created at brine springs that people detected by nature observation. It was only from the first half of the 19th century

that further sources were opened up through deep drilling (first in 1816 near Jagstfeld am Neckar (Emons and Walter 1988). Well drillings led to the flourishing

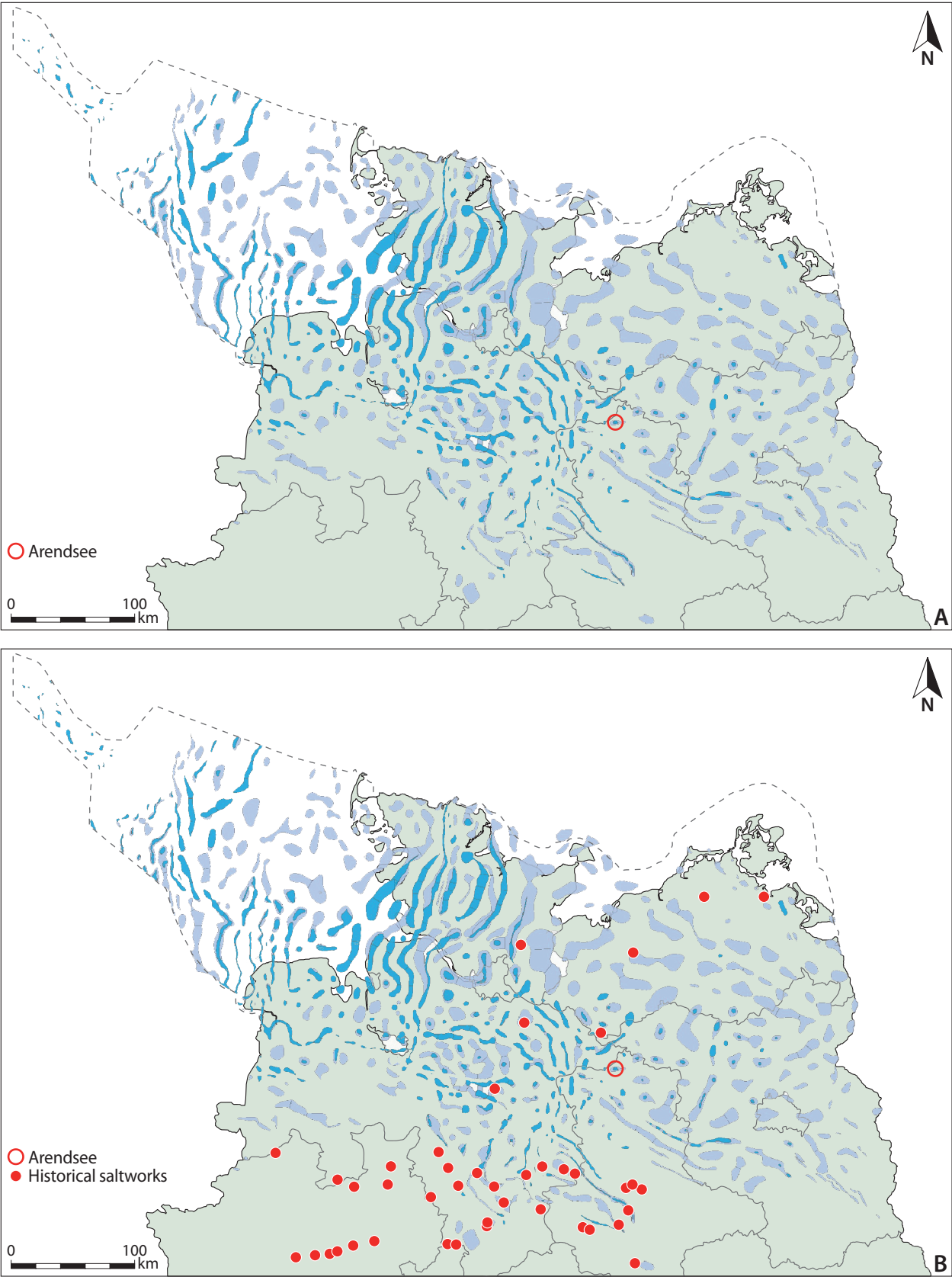


Fig. 3. A Distribution of salt domes in northern Germany (source: BGR 2015). The red circle marks the doline of Arendsee; B Distribution of salt domes in northern Germany and historical saltworks founded before 1817 (Source: Emons and Walter 1988).

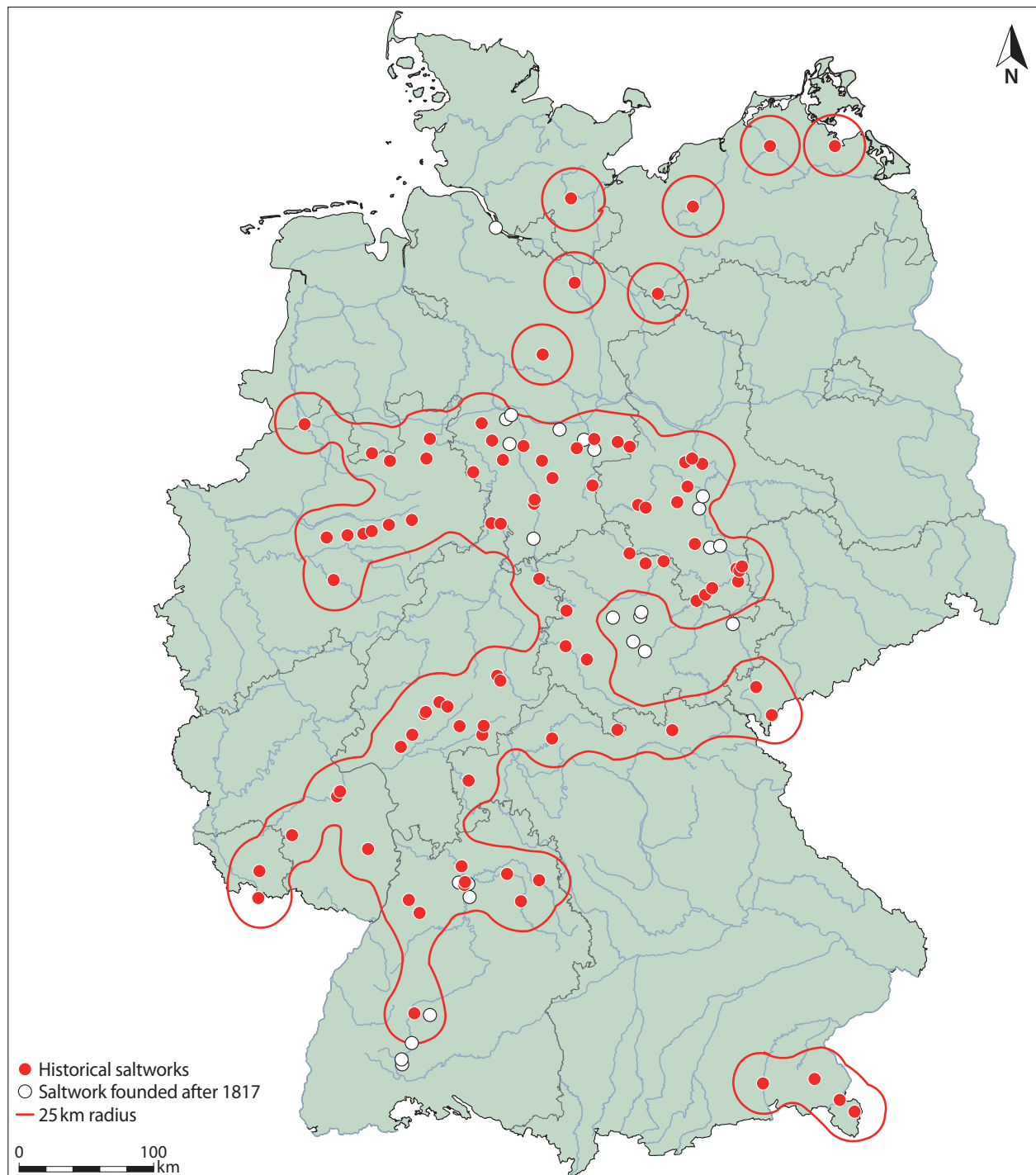


Fig. 4. Distribution of historic and modern saltworks in today's Germany (according to Emons and Walter 1988). The red line marks a 25 km radius.

of some saltworks that could afford this investment and led to a downturn of less productive ones that dealt with brine of lower concentration.

Before this technical innovation, salt production depended on saline surface water or shallow wells that were dug to enhance the quality and availability of

brine. Its occurrence is unevenly distributed in central Europe. Figure 4 shows the distribution of former saltworks in Germany according to Hans-Heinz Emons and Hans-Henning Walter (1988) who have compiled an enormous amount of data on previous and existing salt mines and saltworks. As a number of salt works

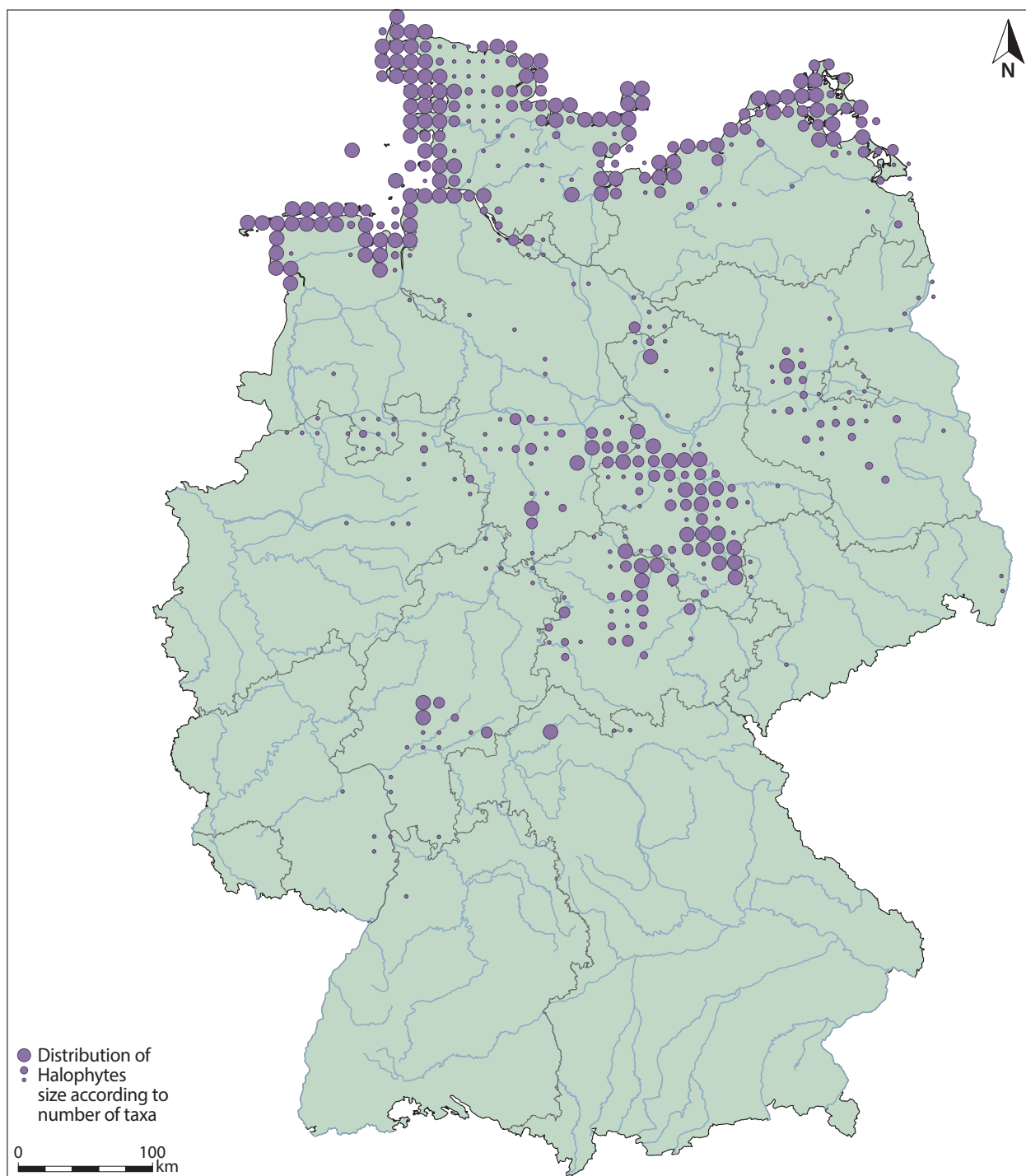


Fig. 5. Distribution of *Salicornia europaea*, *Juncus gerardii*, *Glaux maritima* and *Plantago maritima* (according to Haeupler and Schönfelder 1988; Benkert et al. 1998).

were founded after the invention of deep drilling, all foundations after 1817 are marked with hollow circles. All other saltworks are older foundations that are based on salt springs or brine in shallow wells. The red line marks a 25 km radius. It shows regions of potential availability of brine in the borders of modern Germany

but also areas without any natural sources of salt. The latter are large parts of the federal states of Lower Saxony, Brandenburg, Saxony and Bavaria and also areas in the west and south-west of modern Germany. In northern Germany brine springs have a scattered distribution but salty water was available along the coasts.

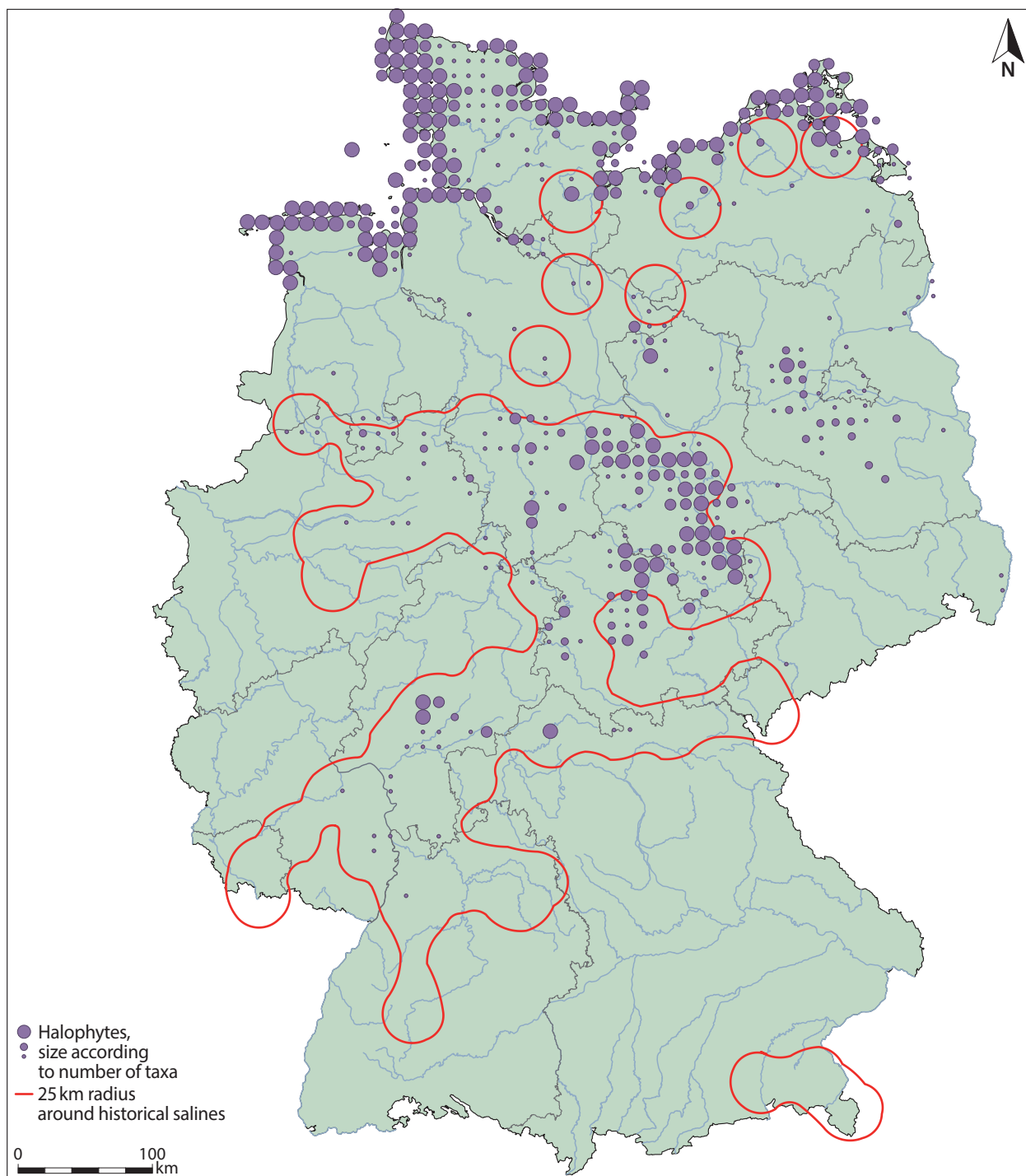


Fig. 6. Distribution of *Salicornia europaea*, *Juncus gerardii*, *Glaux maritima* and *Plantago maritima* (according to Haeupler and Schönfelder 1988; Benkert et al. 1998). The red line marks a 25 km radius around historical salines.

To identify brine springs, in prehistoric times people most likely looked for licking places of wild game or they used their knowledge about plants and their ecological demands. A few plants are adapted to high concentration of sodium-ions in the water. They occur along the marine coastline and at inland brine springs.

Figure 5–7 shows the distribution of the halophytic species *Salicornia europaea*, *Juncus gerardii*, *Glaux maritima* and *Plantago maritima* on the basis of the occurrence on a 10 km x 10 km grid (Haeupler and Schönfelder 1988; Benkert et al. 1998). Illustrations of the plants are given in figure 7. The number of detections of

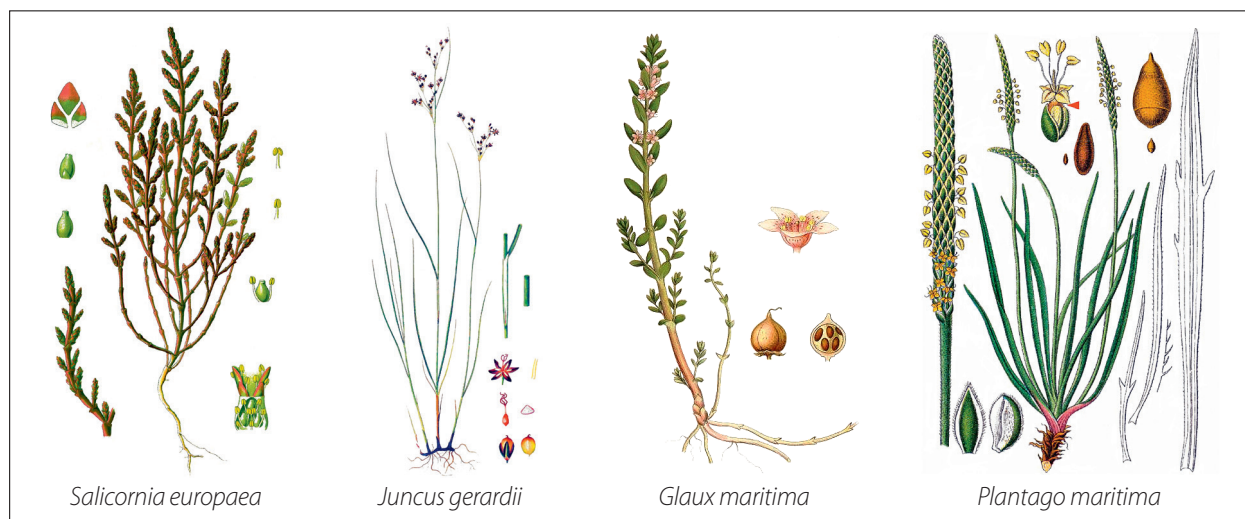


Fig. 7. Illustrations for *Salicornia europaea*, *Juncus gerardii*, *Glaux maritima* and *Plantago maritima* from historical floras.

the four halophytes is analogous to the size of the symbol. They show a very good accordance with the occurrence of historical saltworks as shown in figure 6.

The map shows concentrations along the coasts. Apart from single occurrences the distribution is concentrated in the centre of Germany (northern North-Rhine-Westphalia, southern Lower Saxony, southern Saxony-Anhalt and northern Thuringia). Another concentration marks central Hesse and the very north of Bavaria. Not all places with brine springs that in historic times had saltworks, also have regular occurrences of halophytes. The plants may be extinct or the brine springs have been captured. Thus, the distribution map mainly shows, how common halophytes are today. In places without historical saltworks, like in the federal state of Brandenburg, the occurrences of halophytes might be linked to a low brine concentration. It might have been too low to start effective industrial salt production, but saline groundwater obviously is available and was used in prehistory as finds of Briquetage in the Lower Lusatia area of Brandenburg prove (Bönisch 1993, 2012). Single occurrences of salt plants on this map may also be the result of road salt spreading or industrial pollution.

Apart from the coastal areas, northern Germany has very few proofs of halophytes and the few areas of former salines (red circles) also show occurrence of these plants (violet dots). These are Bad Oldesloe, Sülten/Weitendorf, Bad Sülze, Greifswald, Lüneburg, and Sülze/Bergen. The salt springs are all located in moraine areas, suggesting that the groundwater is influenced by brine, rising from underground salt domes.

Archaeological traces of prehistoric salt production

Several authors have dealt with the production, trade and consumption of salt in prehistory and a number of conferences have focused on this topic (e.g. Weller 2002; Nikolov and Bacvarov 2012; Brigand and Weller 2015; Alessandri *et al.* 2025). For some regions the beginning of salt exploitation is linked to the Neolithic, e.g. for the Andalucian coast (Escacena Carrasco and García Rivero 2019), the Carpathian Basin (Bánffy 2015), South-East Europe (Tasić 2002), Europe in general (Weller 2015) or Central Europe (Saile 2008; Saile 2012). The “places of possible Neolithic salt production” in the area of modern Germany, mapped by Thomas Saile (2012), all are located in the regions of historic salt works or of occurrences of halophytes, as shown in figure 8.

As no traces of the product itself — namely salt — is found in settlements, just indirect indications for production, trade or consumption can be used to reconstruct the role of sodium chloride in past societies. Different techniques for the exploitation of salt were applied in prehistoric times. Mining of relative easily accessible rock-salt was one form. But rock salt deposits do not occur in Central Europe outside the east alpine region. Rock-salt mining was practiced in Reichenhall, Bavaria, and the adjacent mining places of Hallein and Hallstatt in modern Austria (Stöllner 2007) where it started in late Bronze Age and Iron Age. Sometimes the rock-salt was not traded as ingots but solved (wet mining) and the brine was evaporated to produce a clean product. According to Olivier Weller (2015), the oldest traces of mining of rock salt in Europe date back to the Neolithic in Spain (Cardona/Catalonia).

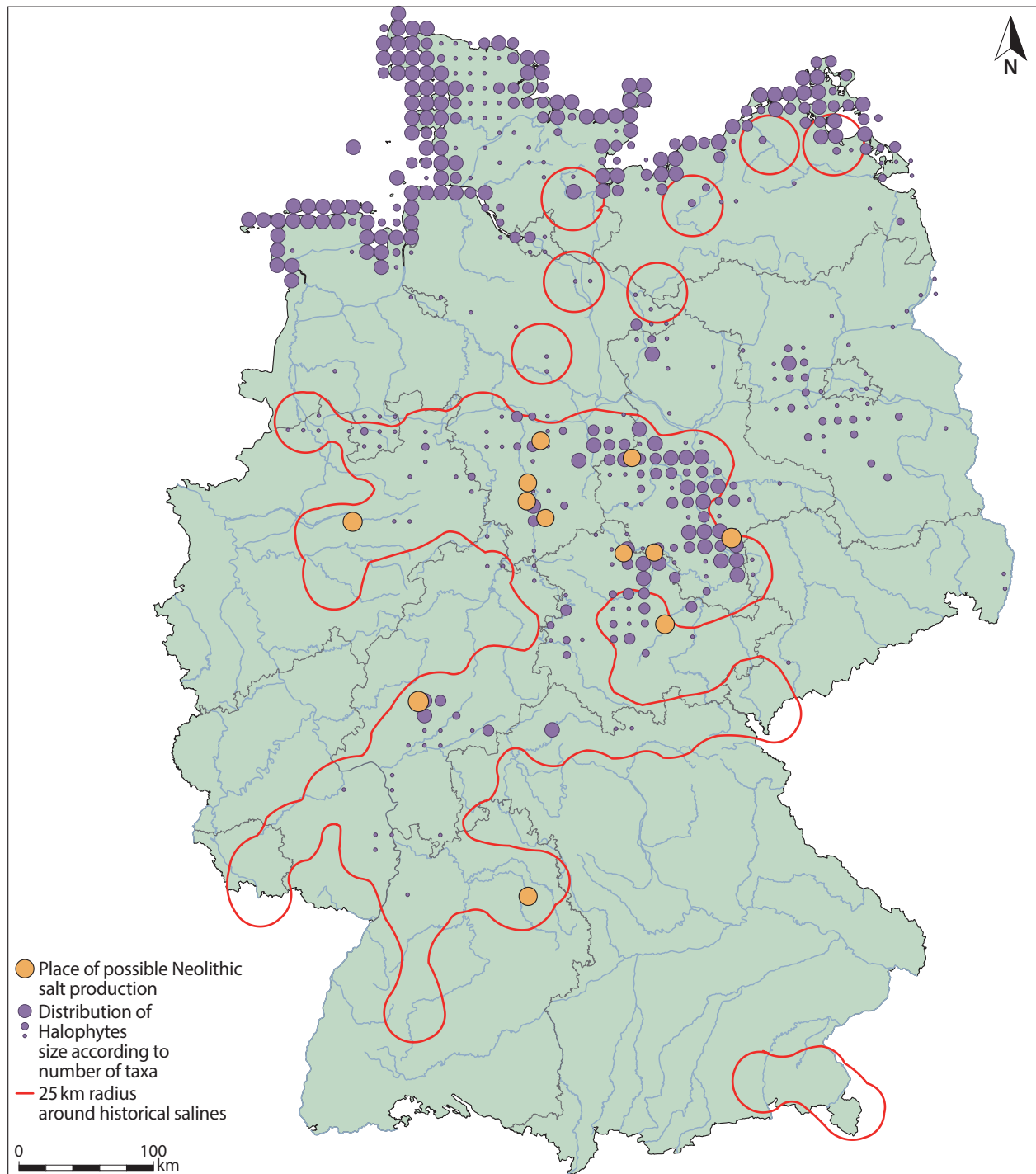


Fig. 8. Places of possible Neolithic salt production (according to Saile 2012), the distribution of historic and modern saltworks in today's Germany (according to Emons and Walter 1988), and the occurrence of halophytes (according to Haeupler and Schönfelder 1988; Benkert et al. 1998).

The evaporation, as a second method, needs a lot of energy to concentrate the brine until salt crystals form. In arid areas, evaporation by solar heat is the method of choice. This technique was used on a large scale in the Roman Empire and is still practiced today along the

Mediterranean and Atlantic coast. In more humid climate the brine has to be heated in vessels or pans using wood as fuel. Huge amount of firewood had to be transported to Lüneburg during the Middle Ages when the town was the main supplier of salt for the Hanse

network (Kahle 1987). Different techniques of filtering and concentration (gradation) of the brine precede this process.

From ethnological observations another technique, *i.e.* the burning of dried salt plants (halophytes) and collection of salt crystals from the ash is reported (Goulet-quer *et al.* 1994).

This type of salt production does not need ceramics. At the coast the salt production out of seaweed or glasswort (*Salicornia europaea*) most probably was established before salt extraction out of seawater with

the complex process of filtering, gradation, and evaporation was established. The dried plant material could be burned without using ceramic and the saline ash traded. From the Roman Iron Age onwards, at the coast of Lower Saxonie and at the westcoast of Schleswig-Holstein a peat soaked in salt water was dug up in the marshes and a black salt was extracted and traded (Lengsfeld *et al.* 1995; Siegmüller and Bungenstock 2010). However, no traces of earlier use of salt peat are known so far.

INDICATION FOR NEOLITHIC SALT PRODUCTION, TRADE AND WEALTH

Thomas Saile (2012) and Olivier Weller (2015) summarise indications for neolithic salt mining and salt extraction from brine in Europe. First indications date back to the Neolithic, *i.e.* the mid of the 5th Millennium BCE for Lesser Poland and the Romanian Carpathians. In modern Germany, no traces of Briquetage is found so far in Early and Middle neolithic contexts. Earliest traces of ceramic potentially used for salt extraction in the area of modern Germany originate from the Halle/Sale region in a Bernburg context and date to around 3000 BCE (Saile 2012; Weller 2015). Before the typical Briquetage ceramic was applied, the production of salt may have produced no typical residues. Concentration of charcoal or ash and features like ditches or basins and tubs may be associated with salt production but also with other activities. Most often the presence of brine makes the use of such features for salt production probable, like in Wolkenwehe, Schleswig-Holstein (Mischka *et al.* 2007) or in Werl, North-Rhine-Westphalia (Leidinger 1983), but they don't prove the production of crystalline salt. Ponds with brine may also have been used for curing meat.

The possibility of local trade in the form of brine transported in animal bladders or stomachs should also be taken into account. With respect to a local trade in this form, in figure 4 the 25 km radius around saline springs (historic saltworks) was drawn. This enables to test the hypothesis of a connection of the occurrence of brine and wealth in the Neolithic.

One indicator for wealth is the occurrence of far traded objects that are interpreted as luxurious goods. Jadeite axeheads are such objects that originate from the Italian part of the western Alps (Monte Viso in Piemonte and Mont Beigua in the Ligurian Massiv). They are distributed all over western Europe. Where they are found in a grave context, *i.e.* in southern Brittany, they represent a prominent position of the buried person. In the area of today's Germany, they are often found as single finds and the dating is linked to a Michelsberg context, the end of the 5th and the first

half of the 4th century BCE (Bérenger 2015). As they represent far distance traded prestige goods they can be taken as indicator for wealth and they may represent a certain social stratification in the region where they are found. Pierre Pétrequin *et al.* (2013; 2015) have identified the source area in Italy and have mapped the distribution of these extraordinary objects. The database with 2247 entries is accessible under <http://jade.univ-fcomte.fr/bdd>. Figure 9 shows the distribution of Jadeite axeheads in the area of today's Germany against the occurrence of brine springs, recorded with a 25 km radius. It is obvious, that Jadeite axeheads are concentrated in the area of Central and Western Germany. Just single finds are recorded from the North, East and Southeast. The northern border of the frequent occurrence of jadeite axeheads matches with the northern border of the area of historical salines. But many axeheads that were found in the west and in the south of modern Germany lie outside the occurrence of brine. Therefore, the availability of salt cannot have been the only source of wealth and prestige, although it may have had an important role. Figure 10 shows the same distribution of Jadeite against the distribution of loess soil according to Frank Lehmkuhl *et al.* (2020) and Early Neolithic settlements. The distribution of Early Neolithic settlements (with a radius of 3,5 km) is provided by Johanna Hilpert *et al.* (2019) based on Joachim Preuss (1998). See also Andreas Zimmermann *et al.* (2009). Both are provided by the uni-koeln dataset repository.

Apart from single jadeite axeheads in northern Germany, in the Southwest and South, nearly all finds match with the distribution of good soils and many also in areas of early neolithic occupation. Thus, the soil quality might be the decisive factor for wealth even though it overlaps to a great extent with the occurrence of brine springs.

Another far traded material, often found in the Neolithic of today's Germany originates from the calcareous shells of the Mediterranean mollusc *Spondylus gaederopus*. The material was exclusively used for

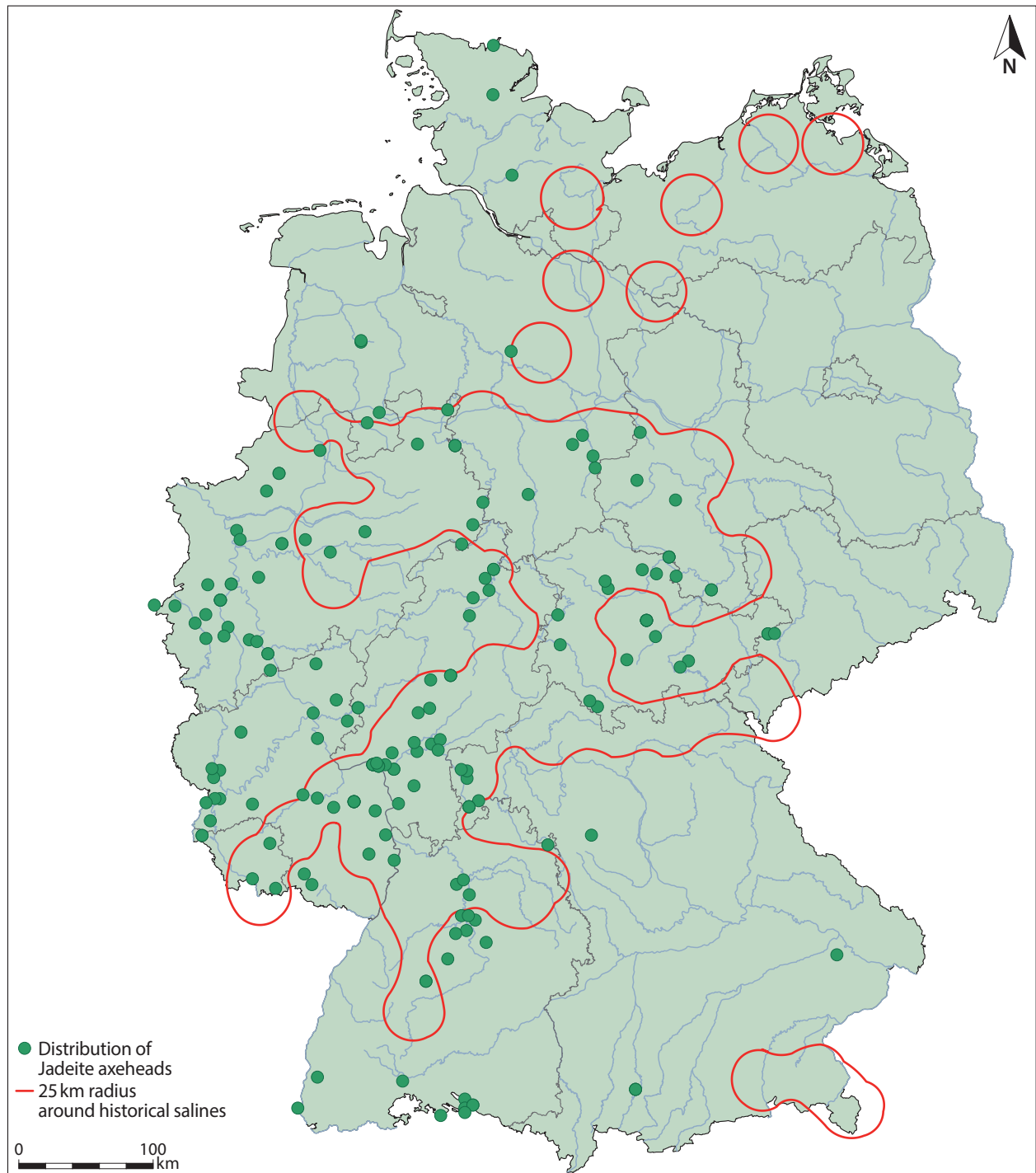


Fig. 9. Distribution of Jadeite axeheads in the borders of today's Germany (according Petrequin et al. 2015) and database JADE: inventaire des haches (<https://jade.univ-fcomte.fr/bdd/index.php>).

jewellery and different rings, beads for necklaces, and disks are the most common found objects. They mainly date to the 5th millennium BCE, even though also palaeolithic *Spondylus* objects are recorded (Windler 2019). They are interpreted as prestige goods (Müller et al. 1996) and are associated with rich burials. The

Spondylus distribution was mapped in 1997 by Johannes Müller, indicating neolithic trade activities with the mediterranean. Bo Gräslund 1972 discussed the occurrence of *Spondylus* artefacts as potential by-product of salt trade from the Mediterranean into central Europe (see also Lund Hansen 1977) but this hypothesis was

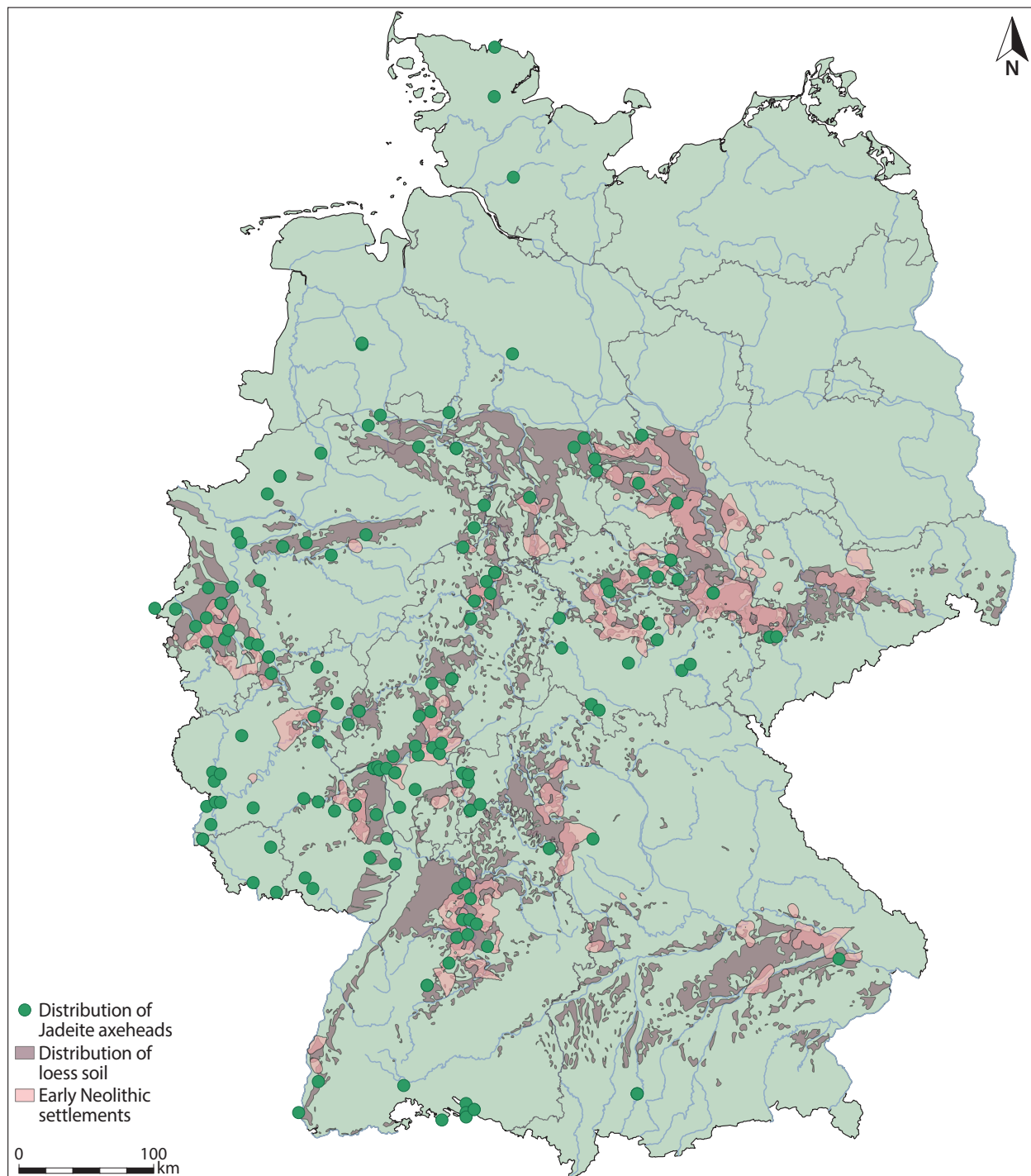


Fig. 10. Distribution of Jadeite axes, of loess soil (according to Lehmkuhl et al. 2020) and Early Neolithic settlements (according Hilpert et al. 2019 based on Preuss 1998).

never proven (Saile 2008). Anyhow, *Spondylus* occurrences are interpreted as indicators of trade and wealth in central European Neolithic and the re-evaluation of finds by Arne Windler (2019) is the basis for the map in figure 11, showing the distribution of Artefacts in the borders of today's Germany against the occurrence of

brine springs, recorded with a 25 km radius. The dataset, provided by Arne Windler on Zenodo open repository (<https://doi.org/10.5281/zenodo.2840333>) contains 8037 artefacts from 489 sites and is focusing on the time between 5500 and 5000 BCE. The distribution differs from that of Jadeite axeheads as there is a

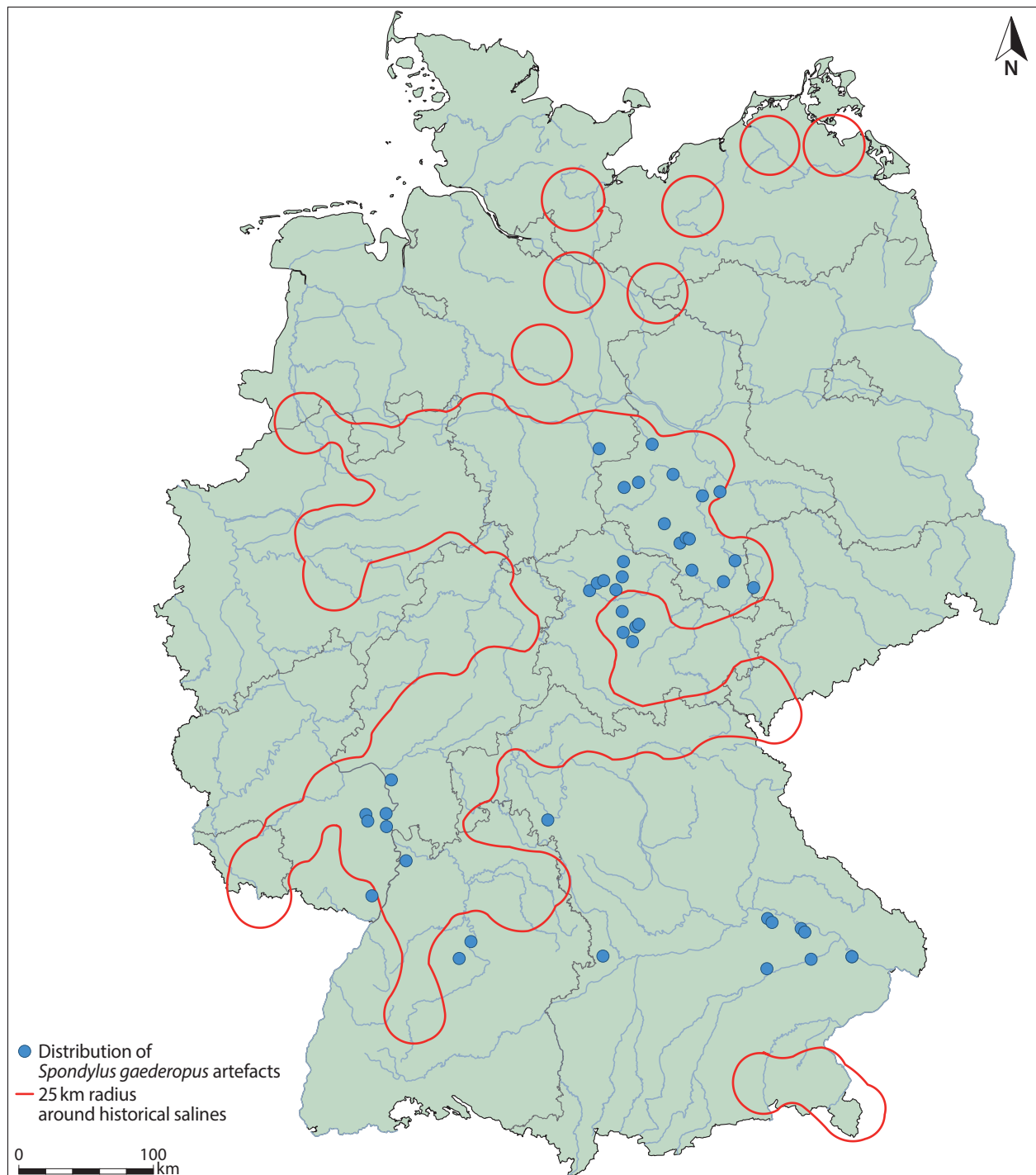


Fig. 11. Distribution of *Spondylus gaederopus* artefacts in the borders of today's Germany (according to Windler 2019). The red line marks a 25 km radius around historical salines.

concentration in central Germany and hardly any find in the West. Apart from a group along the Danube, the most probable trading route, most evidence come from inside or close to the area marked by the occurrences of historical salines. As shown in figure 12, there is also a match with loess soils and early Neolithic settlements

but there are many regions of this category without *Spondylus* records. Thus, the wealth expressed by *Spondylus* artefacts seems better to be linked to some extend to the occurrence of brine even though there are many regions with potential availability of salt without traces of *Spondylus* artefacts.

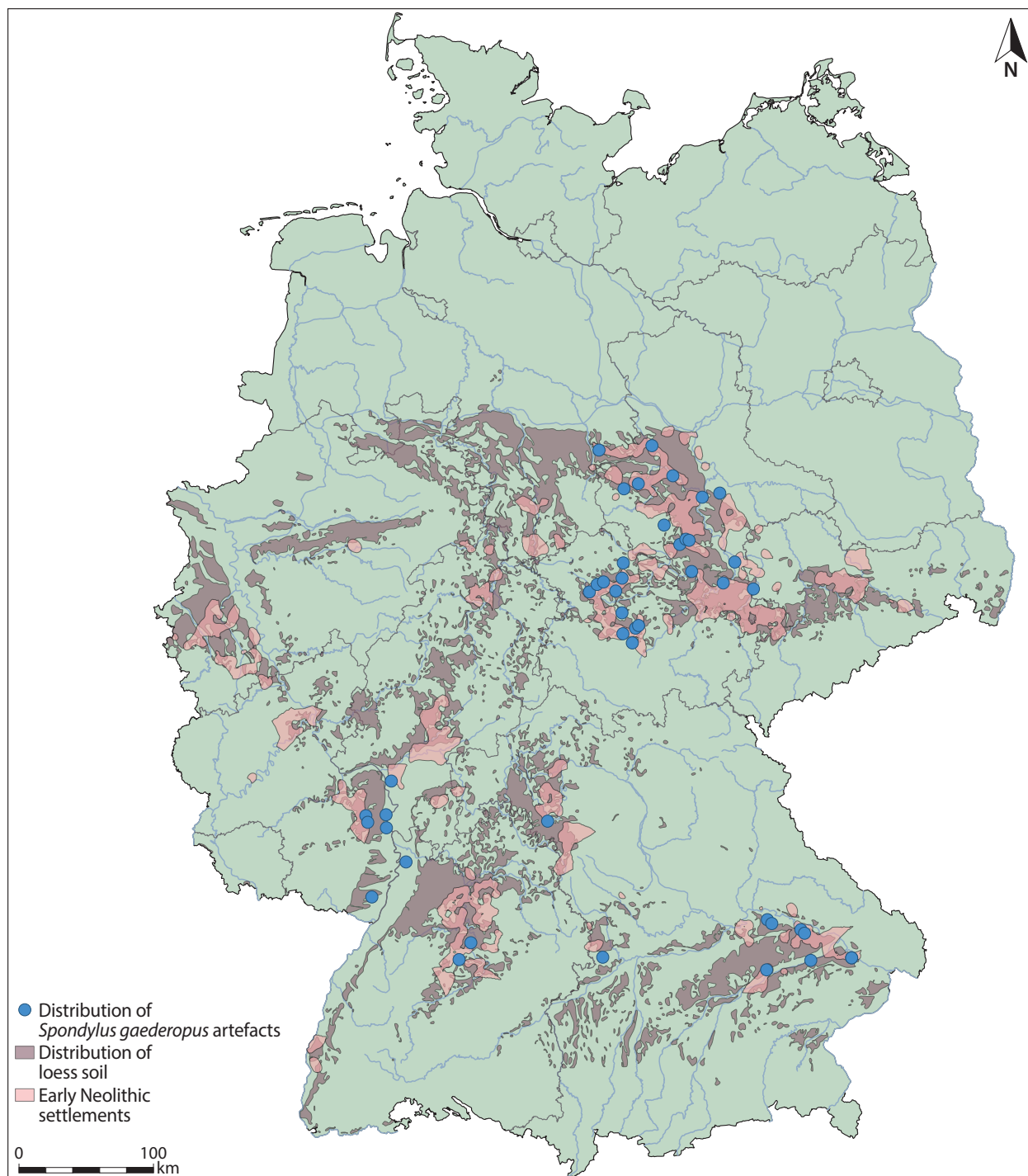


Fig. 12. Distribution of *Spondylus gaederopus* artefacts, brown distribution of loess soil (according to Lehmkuhl et al. 2020) and pink Early Neolithic settlements (according to Hilpert et al. 2019 based on Preuss 1998).

The mapping does not show a simple relation between salt and wealth but it gives a hint to the potential role salt may have had in the Neolithic. As traces of salt production and trade are difficult to detect, especially in times before Briquetage was used, special attention

should be paid to indirect evidence for salt production in areas with brine springs and the occurrence of halophytes. The higher the degree of cereals for the human nutrition, the higher is the demand for salt to compensate the low sodium content of plant tissue.

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Tracing the Oldest Pile Dwellings of Europe

Adapting Neolithic Architecture to Waterscapes

Albert Hafner, Martin Hinz, Mirco Brunner, Adrian Anastasi

KEYWORDS: Neolithic, Bronze Age, wetland sites, Balkans

Abstract

Neolithic and Bronze Age settlement remains in lakes and bogs of the Alpine region have been researched for almost two centuries. The discovery of this peri-Alpine phenomena from 1820 CE on, and the branding of the term ‘pile-dwellings’ in 1854 CE, marks the beginning of settlement archaeology in Europe. New finds from comparable sites in Southern Europe demonstrate that

the geographical dispersion of lakeside settlements extends far beyond the Alpine region. Recent discoveries from excavations and first dendrochronological studies in Albania, Greece and North Macedonia show that the traces of Europe’s oldest pile dwellings lead to the Balkans.

Zusammenfassung

Neolithische und bronzezeitliche Siedlungsreste in Seen und Mooren des Alpenraums werden seit fast zwei Jahrhunderten erforscht. Die Entdeckung dieses perialpinen Phänomens ab 1820 und die Prägung des Begriffs “Pfahlbauten” im Jahr 1854 markiert den Beginn der Siedlungsarchäologie in Europa. Neue Funde aus vergleichbaren Fundstellen in Südeuropa zeigen, dass

die geografische Ausbreitung der Pfahlbausiedlungen weit über den Alpenraum hinausreicht. Jüngste Funde aus Ausgrabungen und erste dendrochronologische Untersuchungen in Albanien, Griechenland und Nordmazedonien zeigen, dass die Spuren der ältesten Pfahlbausiedlungen Europas bis zum Balkan führen.

INTRODUCTION

Prehistoric settlement remains in lakes and bogs, known for their exceptional preservation, have been a subject of interest for archaeology due to the survival of organic materials like wood, bark, fibres, seeds, and fruits over thousands of years. These materials endure in low-oxygen environments, where fungi and bacteria are inhibited, providing unique archaeological insights into the economy, environment, and technology of ancient times. They also provide the basis for the most precise dating method in archaeology so far: Dendrochronology, which has been a standard dating method since the 1980s (Tegel *et al.* 2022; Hafner 2023; Manning 2023). The discovery of piles in Swiss lakes in the 1820s marked a significant shift in archaeological focus, moving from predominantly burial mound

exploration to investigating the daily lives of past societies (UNESCO, 2009; Menotti and O’Sullivan 2012; Fowler *et al.* 2015; Hafner 2023).

By the 19th century, ground-breaking archaeobotanical findings from these pile dwellings — originally misdated as “Celtic” due to then-limited dating techniques — unveiled the first evidence of cereal cultivation, later attributed to the Neolithic and Bronze Age. It is now known that the southern Alpine region’s pile dwellings date back to around 5000 BCE, appearing in the northern Alps about a millennium later. In 2011, UNESCO acknowledged 111 of the most representative sites in the Alpine region as part of a serial World Heritage Site. Recent discoveries in the Mediterranean region have challenged the long-held belief that pile



Fig. 1. Wetland archaeology in Greece. Large-scale rescue archaeological investigations of the Anarghiri IXb site, Florina, Greece (Photo: Tryfon Giagkoulis).

dwelling were unique to the Alpine region, underscoring their broader geographical prevalence.

Ancient texts already mention settlements on pile-supported platforms in lakes and swamps. Herodotus of Halicarnassus described pile-dwelling settlements in Lake Prasias (today's Lake Dorjan in the North Macedonian-Greek border region) in detail in his "Histories" in the 5th century BCE. The archaeological exploration of pile dwellings in the border region of today's Albania, Greece and North Macedonia began in the 1930s with the first discoveries at Lake Ortestida in northern Greece. The Dispilio site near the town of Kastoria was extensively investigated from 1992 onwards (Facorellis *et al.* 2014; Voulgari 2014). In the 2010s, rescue excavations in the region around Florina, triggered by lignite mining, yielded important findings. The large-scale investigations at the Anarghiri IXb site were of particular importance (Fig. 1). In Albania, large melioration projects were carried out from the 1960s onward to drain Lake Maliq in the Korça Basin, during which the first pile-dwelling settlements of Maliq and Dunavec were discovered (Fig. 2; Korkuti 1995; Bunguri 2014; Prendi 2018; Prendi and Bunguri 2018). In North Macedonia, the first prehistoric lakeside settlement was found in 1961 in the outflow of the Drin River near Struga on Lake Ohrid. In the 1990s, scuba divers discovered the settlement sites of Vrbnik and Ploča Micovgrad (Ohrid, North Macedonia) and settlement remains were also recorded during construction work in the urban area of Ohrid (Nau-mov 2020; Hafner *et al.* 2022). Only a few pile-dwelling

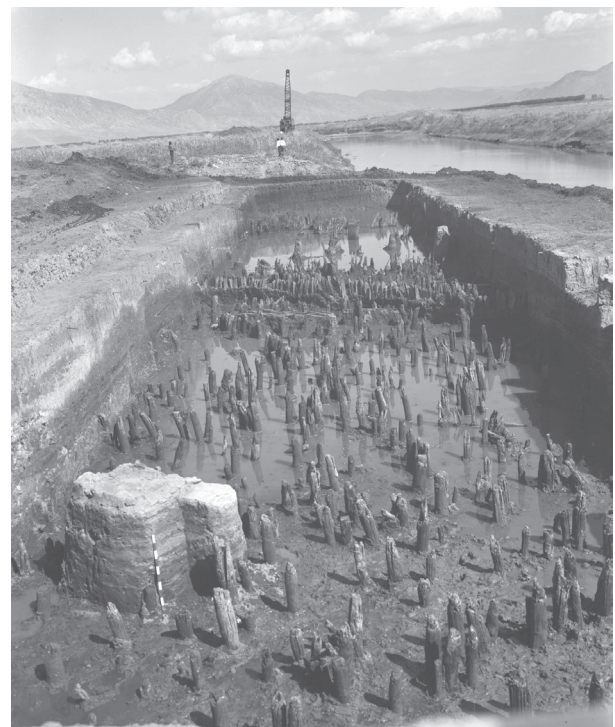


Fig. 2. Wetland archaeology in Albania; above: Maliq, 1960 (Elezi 2020).

settlements are known from the wider Mediterranean region: among others, La Draga in Spanish Catalonia, La Marmotta in central Italy and Zambratija in Croatian Istria (Antolín *et al.* 2022).



Fig. 3. Cover page of the magazine 'UniPress', science magazine of the University of Bern in September 2019.

BETWEEN THE AEGEAN AND ADRIATIC SEAS

Against the backdrop of the major environmental challenges of the 21st century, archaeology plays a crucial role in understanding how ancient societies dealt with their own environmental challenges and what lessons can be learnt for the present. The region between the Aegean and the Adriatic, the so-called “cradle of European agriculture”, provides a unique setting to study prehistoric wetland settlements as palaeoarchives. The advent of agriculture and animal husbandry from western Asia around 8000 years ago triggered significant social changes that affected both the indigenous hunter-gatherers and the migrating agricultural communities.

Since 2018, researchers at the University of Bern have been focussing on the study of prehistoric lakeside settlements in this region, which were built

Until 2020, dating of these western Balkan settlements relied mainly on typology, lacking the dendrochronological and radiocarbon data common in the Alpine region. A significant turn occurred in 2015 with a collaboration between Albanian, Greek, North Macedonian, and Swiss researchers, evolving into a major international project funded by the European Research Council since 2019 (Fig. 3). The ERC synergy project “Exploring the dynamics and causes of prehistoric land use change in the cradle of European farming (EXPLO),” led by the Universities of Bern, Oxford, and Thessaloniki, focuses on the origins of agriculture and livestock farming, land use patterns, and the impact of past climate on living conditions in this critical region between the Aegean and Adriatic. This interdisciplinary project integrates archaeological, archaeobiological, palaeoecological methods, and dynamic modelling, merging on-site excavation data with off-site palaeoenvironmental information. This combination aims to provide a comprehensive understanding of past adaptation strategies and the early agrarian societies' environmental impact (Hafner *et al.* 2021; Reich *et al.* 2021; Bolliger *et al.* 2023; Brechbühl *et al.* 2024; Maczkowski *et al.* 2024). The objectives also include the transfer of knowledge to the participating countries to enable them to sustainably research complex wetland settlements themselves in the future. It is also important to protect these exceptional and fragile sites and to preserve them as a historical resource for future generations.

between 6000 and 500 BCE. These sites are mainly located around Lake Ohrid, which stretches between Albania and North Macedonia, near the former Lake Maliq in the Korçë Basin in Albania and near several smaller lakes in Greece (Fig. 4). Lake Ohrid is located at an altitude of 695 metres above sea level, has an area of 350 km² and, with an age of 1.36 million years, is one of the oldest lakes in the world (Matzinger *et al.* 2006; Albrecht and Wilke 2008; Wagner *et al.* 2017). Finds at the Prespa lakes are surprisingly rare, which could be related to the different topography of these bodies of water. This research sheds light on how these early societies adapted to and interacted with their environment and provides valuable perspectives on today's ecological challenges.

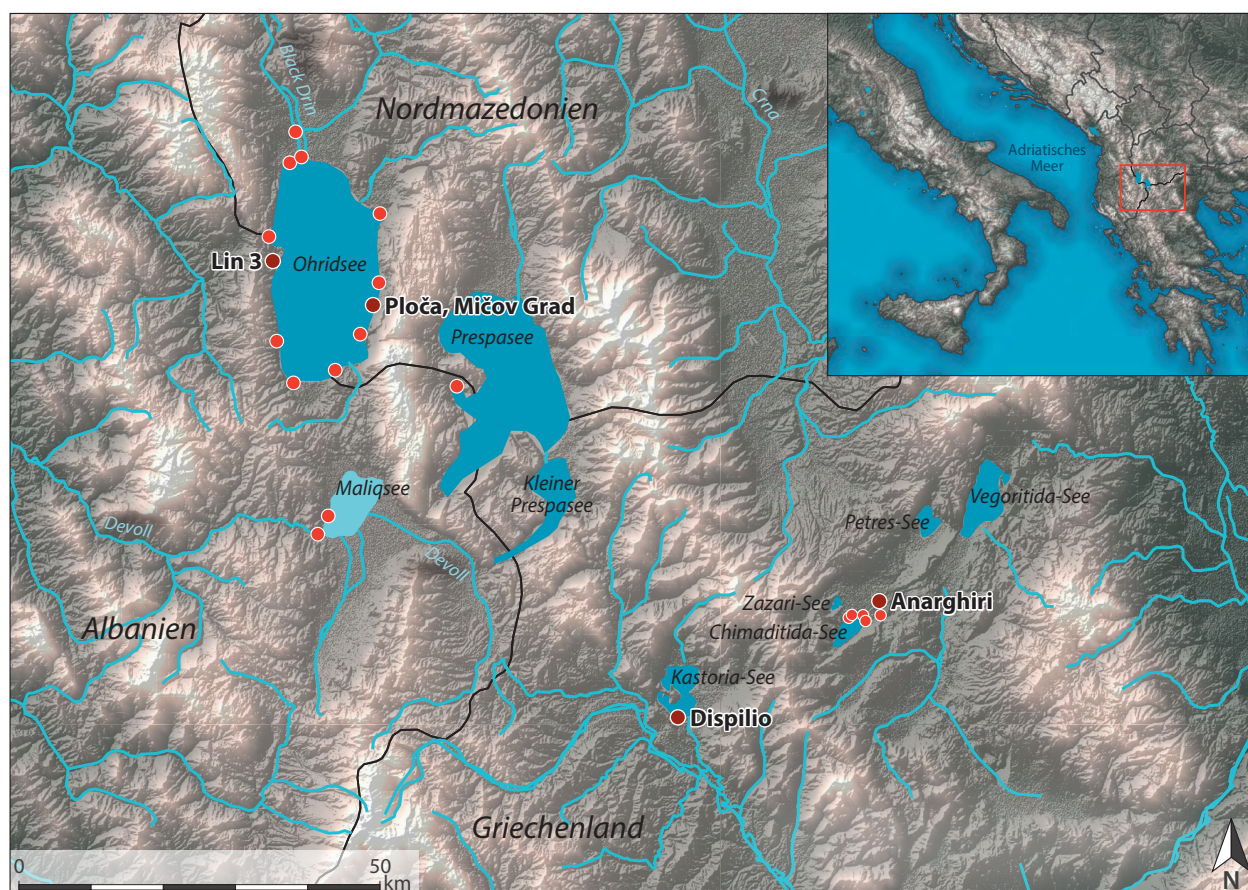


Fig. 4. Prehistoric lakeside settlements in the Western Balkans in the tri-border region of Albania, North Macedonia and Greece (Map: Andrea Bieri).

DENDROCHRONOLOGY AND MIYAKE EVENTS

One of the aims of the EXPLO project is to compile a so far completely missing dendrochronology for the southern Balkans. Before the start of the project, prehistoric wood samples from submerged settlement remains had never been systematically collected. This requires extensive and costly underwater excavations lasting several weeks over several years. In collaboration with local partners, meanwhile over 3000 wood samples have been documented, sampled and dated using a combination of dendrochronology and radiocarbon dating. These samples form the basis for numerous “floating” (dendro-) chronologies, which range from the 6th to the 1st millennium BCE. The term “floating” indicates that these are not fixed by a complete tree-ring calendar, as is the case in the Alpine region of Central Europe. They can therefore only be dated using radiocarbon dates (Bayesian modelling, so-called “wiggle matching”), and thus achieve an accuracy of ± 1 –2 decades. A completely new approach uses solar eruptions dated to their exact year to convert the “floating” chronologies into “absolutely

dated” chronologies. Here, increased ^{14}C values in precisely dated tree ring series form anchor points that are reproduced in “floating” chronologies. The methodological principles were published in 2012, but anchor points for prehistoric time periods have only been available since 2022 (Miyake *et al.* 2012; Brehm *et al.* 2022). So far, only five of these so-called “Miyake events” are known (993 and 774 CE as well as 664/663, 5259 and 7176 BCE). These solar events had a global effect. They therefore allow the determination of year-specific dendrochronological dates from archaeological samples without having to rely on a continuous regional calendar. The Bern dendrochronology team of the EXPLO project has already achieved significant results at several sites. Published are those from Ploča Mičov Grad, Lake Ohrid, North Macedonia (Hafner *et al.* 2021; Bolliger *et al.* 2023), Sovjan on the former Lake Maliq, Albania (Maczkowski *et al.* 2021), and Dispilio, Lake Orestiada, Greece (Maczkowski *et al.* 2023). The overall aim of this strategy is to consolidate the chronologies of

the individual sites into a comprehensive regional master curve. Here we present a summary of three dendrochronological case studies:

- In Ploča Mičhov Grad, North Macedonia, on the eastern shore of Lake Ohrid, 800 wooden piles were documented and sampled during underwater excavations over an area of 90 m² in 2018/2019. The dendrochronological analysis revealed numerous well-reproduced tree ring chronologies, with high agreement between the species oak, pine, juniper, ash and hop hornbeam (Bolliger *et al.* 2023). The results prove intensive settlement phases in the middle of the 5th and in the 2nd millennium BCE. Furthermore, the precise, relative felling dates show multi-phase occupation with a minimum duration of between 17 and 87 years. Radiocarbon dates, obtained in the course of archaeobiological and palaeoecological investigations on sediment cores from the site, date the settlement activity in Ploča Mičhov Grad to around 1000 years earlier, from around 5500 BCE.
- Sovjan on the former Lake Maliq in south-eastern Albania is of supra-regional importance due to the preservation of organic materials from the Neolithic to the Iron Age and an extensive and well-researched stratigraphic sequence. There is a complete house floor plan that still features rising wattle and daub walls. Dendrochronologically, this structure and a connected plank track could be dated to between 2160 and 2140 BCE using a tree-ring chronology spanning 269 years (Maczkowski *et al.* 2021). This is the first time that the Early Bronze Age layers of Sovjan have been chronologically precisely dated, providing a point of reference for the entire region.
- A decisive dendrochronological breakthrough was achieved only recently with the dating of a juniper tree-ring chronology from Dispilio spanning 303 years, using for the first time the Miyake event of 5259 BCE, which was only discovered by ETH Zurich in 2022 (Maczkowski *et al.* 2023). This represents a paradigm shift in dendrochronology. For the first time, this dating method can be used independently of continuous tree-ring calendars. The Dispilio chronology was precisely dated to the final year 5140 BCE. Dispilio is therefore the first Neolithic site in the entire Mediterranean region to be absolutely dated.



Fig. 5. Neolithic lake shore settlements of Lin 3, Lake Ohrid, Albania. Location of onshore coring (2020), trenches (field 1–5) in the lake, and the trenches T 1000/2000 and T 4000–7000 on the shore area (base map Google satellite, images © 2024 Airbus,CNES/Airbus,Maxar Technologies, map data © 2024 Google).



Fig. 6. Neolithic lake shore settlements of Lin 3, Lake Ohrid, Albania. View over the excavation area. Mountains of North Macedonia on the opposite side of Lake Ohrid (Photo: Nicholas Linke).



Fig. 7. Neolithic lake shore settlements of Lin 3, Lake Ohrid, Albania. Ambiance during the underwater excavation of 2023, fields 4–5 (Photo: Nicholas Linke).



Fig. 8. Neolithic lake shore settlements of Lin 3, Lake Ohrid, Albania. Ambiance during the land excavation of 2023, trench 7000 (Photo: Mathias Camenzind).

LIN 3, ALBANIA – A NEOLITHIC KEY SITE AT LAKE OHRID

The Neolithic lakeside settlement of Lin 3 is located on the western shore of Lake Ohrid, south of the prominent peninsula near the village of Lin. Although the precise date of the discovery of Lin 3 remains elusive, it is likely that local divers first observed the site in the 1990s. At the same time, farmers in the area were engaged in the construction of drainage channels, in which Albanian archaeologists identified remnants of wood and pottery. Unfortunately, the rapid flooding by water prevented any comprehensive documentation efforts at that time.

The site's first systematic archaeological exploration began in 2020 with mechanical drilling under the EXPLO project, focusing on the northern extension of the onshore area (Fig. 5 and 6). Subsequent underwater excavations took place in 2021 in the lakeward area to clarify the situation there (Hafner *et al.* 2021; Bolliger *et al.* 2023). This was followed in 2022 by several trenches in the landside bank area. These were continued in 2023, and a further underwater excavation was also carried out in 2023 (Fig. 7 and 8). The extent

of the Lin 3 site covers an oval at least 400 metres long and 200 metres wide, which corresponds to an area of over 6 ha.

So far, underwater excavations at Lin 3 have covered around 280 m², with land excavations accounting for approximately 50 m². The investigations to date show that the land-side parts of the archaeological layers are well protected under sediments with a thickness of around 1.5 m. The underwater excavation in 2021 took place closer to the shore and largely intact archaeological layers were found on the lakebed. Similar to the sites in the Swiss lakes, there is also an acute risk of erosion of archaeological layers at Lake Ohrid submerged sites. The underwater excavation of 2023 was carried out further towards the lake, where an eroded pile field was found without stratification, but with remarkable massive palisade finds (triple staggered thick rows of piles). Massive defensive systems with walls and ramparts are known primarily from Neolithic sites in Thessaly, especially from the well-studied, world-famous settlements of Sesklo and

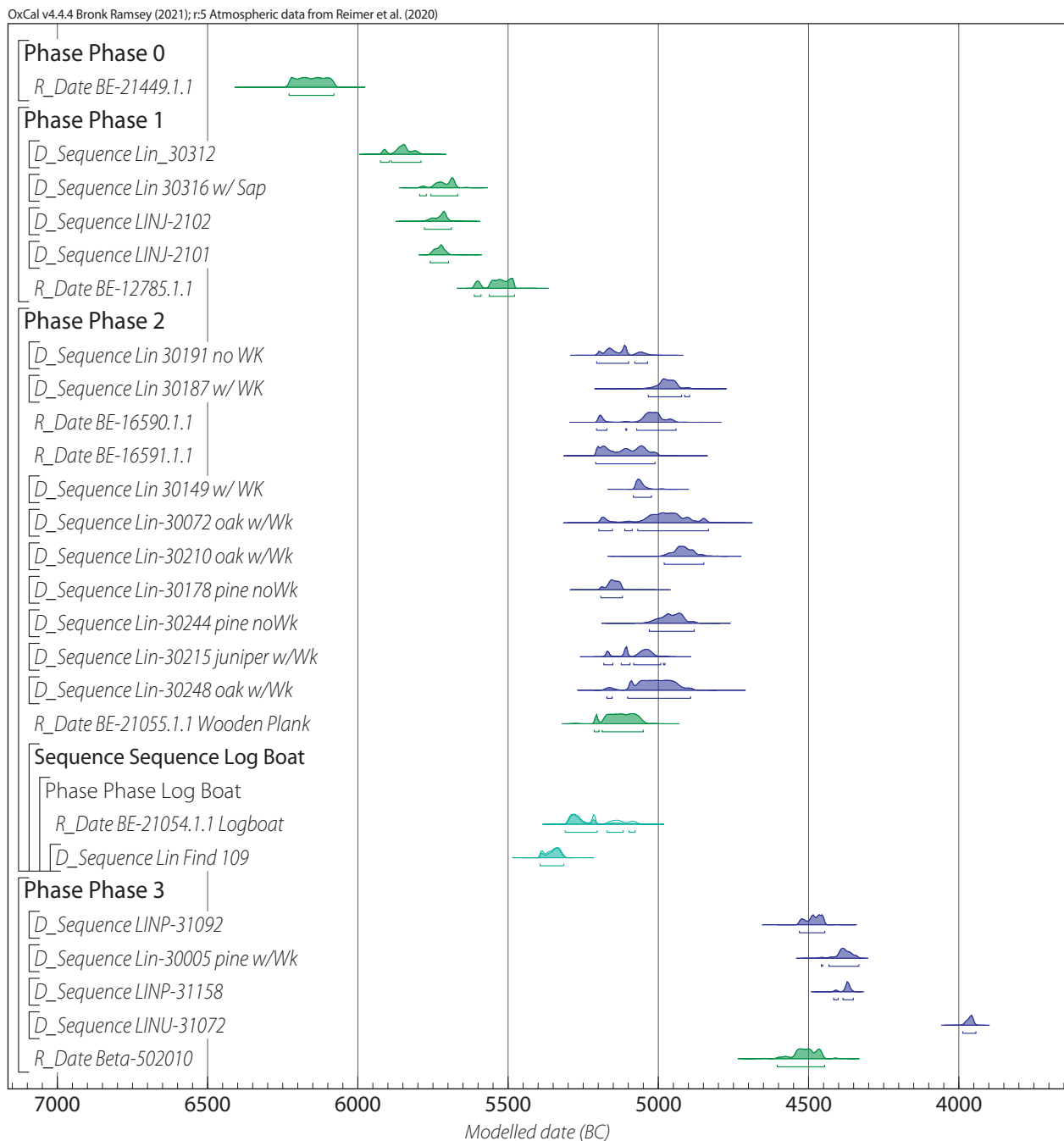


Fig. 9. Neolithic lake shore settlements of Lin 3, Lake Ohrid, Albania. Calibrated radiocarbon dates between 6200 and 4300 BCE. Calibration program: OxCal 4.4. Green: from Wetland/Shore excavation; Blue: from Underwater Excavation; Turquoise: Log boat from Wetland/Shore excavation. Note that each D_Sequence represents the result of a wiggles matching from tree rings and might represent 2-4 individual radiocarbon dates.

Dimini (near Volos, Greece, Runnels *et al.* 2009) but also from the site of Anarghiri IXb in Greece (Giagkoulis 2019).

In total, more than 700 piles were recovered during the 2021–2023 excavations at Lin 3. The types of wood mainly include oak, pine and juniper. They are generally suitable for dendrochronological dating, as

previously published data show (Bolliger *et al.* 2023). As emphasised the settlement remains in the western Balkans could only be dated typologically until recently. In contrast to the Alpine region, no dendrochronological and only very few radiocarbon dates were available until 2020 (Hafner *et al.* 2021).

The dendrochronological investigations of the wood samples recovered in 2021 were a major challenge. It was only through further samples, especially numerous pines from the 2023 campaign, that investigations in autumn 2023 made it possible to successfully establish dendrochronological mean curves from the Lin 3 assemblage for the first time. For the time being, the dating of the Lin site is therefore still based on numerous radiocarbon dates taken from tree rings (Fig. 9). These vary between 6200 and 4000 cal BC, but form three clusters: around 6000/5800 BCE, around 5300/4800 BCE and around 4400/4000 BCE. Given the extensive settlement remains and the range of radiocarbon dates spanning the entire 6th and 5th millennium BCE, it is reasonable to infer that Lin 3 witnessed

the establishment and eventual decline of multiple settlements throughout its 2000-year history of human habitation. The ongoing compilation of dendrochronological mean curves holds promise for their integration into a master curve. Even more promising is the fact that the Miyake event of 5259 BCE, acting as an anchor point for “floating” chronologies, falls exactly within the centre of the ¹⁴C data cluster of Lin 3. This, in turn, allows for an absolute, year-precise dating within this particular period (Maczkowski *et al.* 2024). There is therefore justified hope that the Lin 3 site can link several “floating” chronologies from waterlogged sites of the area into a robust, multi-century dendrochronological (absolutely fixed) master curve.

EXPANSION OF EUROPEAN AGRICULTURE

The research carried out in the EXPLO project since 2018 is still in its early stages. The ongoing research emphasises the great potential that wetland settlements offer for the study of human history. The new, precise dating once again demonstrates the great importance of a solid chronological basis for archaeological research. Originally, the sites were believed to date vaguely from the Bronze and Iron Ages (between 1200 and 800 BCE). However, the investigations revealed that numerous sites in Albania, Greece and North Macedonia date back to the 6th millennium BCE. Radiocarbon dating at Lin 3, situated on Lake Ohrid in Albania, indicates that the earliest dates trace back to approximately 6200–6000 BCE. Together with similarly early data from other sites in the region, they prove that the lakes in the western Balkans were already preferred settlement area in the early 6th millennium BCE. They represent the

earliest European farmers who adapted to a lifestyle influenced by water and the risks of flooding due to annual or climate-induced rises in the lake's water levels. These early settlements feature novel residential and defence structures that differ from the settlement mounds (tells) of Aegean Thessaly.

Current findings suggest that these sites are Europe's oldest known pile dwellings, potentially indicating that the concept of pile dwellings originated in this region and later spread to the Alpine area. Alternatively, it could represent an independent adaptation to living in partially or permanently flooded areas (Fig. 10). Settlements on the shore or in shallow water zones offered both challenges, like rising water levels, and advantages, such as defensive benefits and improved mobility and communication via dugout canoes.

The lake region in the border area of Albania, Greece and North Macedonia situated at 700–800 m above sea level in the mountainous hinterland between the Aegean and the Adriatic, was of central importance for the spread of agriculture to the north. Two major agricultural expansion routes met here. It is intriguing that there is evidence of such early farmers in this region, despite the less favourable climatic conditions compared to the coastal areas of the Aegean and the Adriatic. As part of the EXPLO project, in addition to archaeological material, sediment samples are taken for archaeobiological and palaeoecological studies to investigate the land use practices and economy of these early farming communities. This comprehensive approach will shed light on the spread of agriculture in Central Europe, the climatic challenges and the adaptations of these pioneer farmers. The lakes of the Western Balkans thus represent one of Europe's most important archaeological treasures and offer invaluable insights into the continent's early agricultural history.



Fig. 10. Adapting to life on the water in a lake on Sulawesi, Indonesia, beginning of the 20th century. The ‘Pfahlbaudorf Matanna’ (Photo: Paul Sarasin and Fritz Sarasin [1905]).

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Communal Architecture in the Neolithic and Copper Age of Southeast Europe

Robert Hofmann, Liudmyla Shatilo

KEYWORDS: communal buildings, Neolithic, Chalcolithic, Central Europe, Southeastern Europe, Eastern Europe, Western Asia, group size, visibility, monumentality

Abstract

In the public space of large aggregated Trypillian settlements (c. 4200–3600 BCE) in the forest-steppe zone northwest of the Black Sea, architectural structures interpreted as the remains of communal buildings have been discovered in the last two decades with the participation of a team from Kiel University led by Johannes Müller. In order to contribute to a better understanding of this discovery in the wider context of European prehistory, we review the possible evidence for communal buildings in the Neolithic and Chalcolithic in Central, Southeastern and Eastern Europe in this paper. In doing so, we choose a large-scale and long-term perspective, covering the period from 10.000 to 3000 BCE in an area extending from Mesopotamia in present-day Iraq to the region north of the Alps. On the basis of a sample of 200 possible public buildings and 200 settlement

plans, we investigate where and when communal buildings are detectable in Neolithic and Chalcolithic settlements and which criteria may be relevant for their identification. Moreover, we examine under which circumstances such buildings become visible and take on monumental characteristics, which public functions they may have had and which social implications can be derived from them. While it is difficult to verify the public character of claimed communal buildings in some periods and regions (e.g. Central and Southeastern Europe), in other contexts they emerge with great clarity and are visually emphasised. The latter cases largely concerned social settings where there was apparently an increased need for ideological underpinning of newly established forms of social coexistence and political forms of organisation.

Zusammenfassung

Unter Beteiligung eines Teams der Kieler Universität, geleitet von Johannes Müller, wurden in den letzten zwei Jahrzehnten im öffentlichen Raum großer aggregierter Trypillia-Siedlungen (ca. 4200–3600 v. Chr.) in der Waldsteppenzone nordwestlich des Schwarzen Meeres architektonische Strukturen entdeckt, die als Überreste kommunaler Gebäude interpretiert werden. Um zu einem besseren Verständnis dieser Entdeckung im weiteren Kontext der europäischen Vorgeschichte beizutragen, untersuchen wir in diesem Artikel die möglichen Belege für kommunale Gebäude im Neolithikum und Chalkolithikum Mittel-, Südost- und Osteuropas. Dabei wählen wir eine großräumige und langfristige Perspektive, die den Zeitraum von ca. 10.000 bis 3000 v. Chr. in einem Gebiet abdeckt, das sich von Mesopotamien im heutigen Irak bis zur Region nördlich der Alpen erstreckt. Anhand einer Stichprobe von 200 möglichen öffentlichen Gebäuden und 200 Siedlungsplänen untersuchen wir,

wo und wann kommunale Gebäude in neolithischen und chalkolitischen Siedlungen nachweisbar sind, welche Kriterien für ihre Identifizierung relevant sein können, unter welchen Umständen solche Gebäude sichtbar werden und monumentale Merkmale annehmen, welche öffentlichen Funktionen sie möglicherweise hatten und welche sozialen Implikationen sich daraus ableiten lassen. Während es in manchen Epochen und Regionen (z. B. in Mittel- und Südosteuropa) schwierig ist, den öffentlichen Charakter von mutmaßlichen kommunalen Gebäuden zu verifizieren, treten sie in anderen Kontexten mit großer Klarheit hervor und sind visuell hervorgehoben. In den letztgenannten Fällen handelte es sich größtenteils um Kontexte, in denen offenbar ein erhöhter Bedarf an ideologischer Untermauerung neu etablierter Formen des gesellschaftlichen Zusammenlebens und politischer Organisationsformen bestand.

INTRODUCTION

Nowadays, numerous buildings with different public functions are commonplace. Specialised sacred and administrative buildings, medical and educational institutions, industrial and entertainment centres, *etc.* are manifestation and result of complex multi-level social organisation of densely populated state formations

(Fig. 1). The origin, character and public functions of such buildings in the pre-state and early state periods have been the subject of numerous studies. This includes the Neolithic and Eneolithic periods in south-eastern Europe.

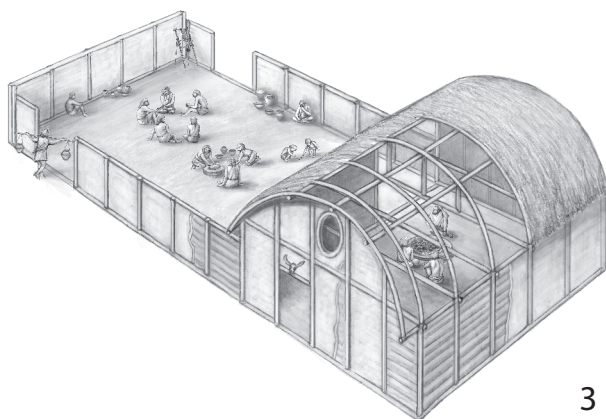


Fig. 1. Contemporary and prehistoric public buildings. 1 Morung house in the Wuilong Village, NE India (Photo: Liudmyla Shatilo); 2 Village shop and informal meeting place in Stolniceni, Moldova (Photo: Robert Hofmann); 3 Maidanetske, Ukraine, reconstruction of a Copper Age mega-structure in Maidanetske, Ukraine (Graphic: Susanne Beyer, Robert Hofmann); 4 Zemaljski Muzej Bosne i Hercegovine (Photo: Sara Jagiolla).

It has long been debated whether specialised communal architecture existed in the Neolithic and Eneolithic of Central and South-Eastern Europe similar to temples and special purpose buildings in Western Asia (e.g. Gimbutas 1980; Jovanović 1991; Lichter 2014; Ebersbach 2010). Based on an idealistic paradigm, according to which the ideological and religious sphere was one of the most important driving factors for the processes of the domestication of natural resources (Neolithisation), of urbanisation and the emergence of states (cf. Bernbeck 2013), evidence for possible public buildings are primarily interpreted as sacred architecture (temples, sanctuaries), among other things because

it seemed to be a necessary concomitant of a postulated 'civilisation' of 'Old Europe' (e.g. Gimbutas 1980; Haarmann 2011). With reference to the ambivalent source situation these interpretations have been criticised (Lichter 2014). Meanwhile, the source base has improved. Particularly, research on Trypillia settlements in Eastern Europe has led to ground-breaking new discoveries of communal architecture that make a renewed discussion of the issues seem useful (e.g. Chapman *et al.* 2014a; Rassmann *et al.* 2014; Ursu and Țerna 2015; Müller and Videiko 2016; Hofmann *et al.* 2019a; Ohlrau 2020a; Gaydarska 2020).

In our paper, we would like to discuss the consequences of these discoveries for the question of the existence of communal architecture and institutionalised social organisation in the wider context of Neolithic and Chalcolithic societies of south-eastern Europe from the 7th to the 4th millennium BCE. We would like to focus on the study of communal buildings, leaving aside special types of public facilities like, for example plazas or rondels. On the one hand, only 'special' buildings can be systematically compared with domestic dwellings. On the other hand, systematic archaeological investigations of open areas are a rarity in the working area (with the exception of rondels), and the interpretation of public spaces is much more difficult, both in terms of their verification and their comparison with open spaces for private use.

In this research we want to consider the following questions:

1. where and when communal architecture is detectable in Neolithic and Copper Age settlements,

2. which criteria are used to identify public architecture,
3. why such buildings are identified in some contexts and in others not,
4. how such buildings are manifested within settlements,
5. which public functions these buildings could fulfil and
6. which social implications can be derived from their size.

From a long-term and large-scale perspective, we hope to achieve a better understanding of the evidence for communal buildings in Central, South-eastern and Eastern Europe. Since in our view, among other things, the long-running debate about religious architecture can only be understood in a broader temporal and spatial context, we include evidence from Western Asia in our study, where historical evidence for temples and palaces has been attempted to be projected back to preliterate periods.

TERMINOLOGY: PUBLIC ARCHITECTURE OR TEMPLE?

Communal or public architecture is an 'umbrella' term for a wide range of architectural structures with a variety of possible functions, whose common characteristic is that they fulfil 'public' functions for a local or regional population, or for parts of it, beyond the 'private sphere' of individual households. The identification of such structures depends largely on the explanatory power of the archaeological sources and the theoretical framework of interpretation. The latter can often only be inferred implicitly. In many cases certain public functions of buildings are already suggested by the labels used, for example, temple, sanctuary, kinship cult building, assembly house, large ritually associated buildings or storage buildings. In other cases, more descriptive terms are used, such as mega-structures. On contrast, the term integrative architecture is focusing particularly on the social functions of such buildings. In prehistoric/pre-literate contexts, we believe that it is better to use neutral terms such as communal buildings, public buildings, non-domestic buildings or special-purpose buildings, as they give more credit to the gaps in our knowledge.

TRYPILLIA MEGA-STRUCTURES

Aggregated Trypillian settlements (*c.* 4250–3600 BCE) represent a complex phenomenon among other things in social terms. On the one hand, it consists of a dense network of large to huge, carefully planned settlements

When interpreting communal buildings, the following observations should be considered:

1. In non-state, non-ranked societies, public buildings usually have or had a multifunctional character (Adler 1989; 2002; Adler and Wilshusen 1990).
2. In human communities, households have different degrees of autonomy and people cooperate with each other at the local level in different intensities and forms. It can therefore be difficult to distinguish the public from the private sphere (Finlayson 2024).
3. The sacred and profane spheres in non-state societies are and were probably much more closely intertwined than they are today. If the existence of temples, sanctuaries or 'communal cult buildings' is postulated, it must be critically examined, if such specialised functions are likely given the degree of social complexity. The situation is somewhat simpler with the concept of 'shrines', which can occur both in the domestic sphere and in isolation (Rollefson 2005).

with a highly developed material culture, which very likely comprised large populations. On the other hand, the distribution of finds and the massive architecture of houses show no pronounced social differences, as it

is often assumed for large, complex societies. In addition, there are no regular graveyards recorded where social differences might be identifiable.

Assumptions about the presence of non-residential buildings for special purposes in Trypillian settlements were based on the interpretation of some house models (Passek 1938), excavations of several houses with extraordinary inventory (e.g. Makarević 1960) and non-typical architecture (Videiko 2004). In the second half of the 20th and early 21st century, the labels ‘sanctuaries’ or ‘temples’ were mainly used for such buildings.

Since the late 2010s, linked to a new phase of intensive research at Trypillia settlements, significant progress has been made in identifying communal buildings that were labelled mega-structures.¹ This progress was possible largely due to sampling-based research strategies including high-resolution and large-scale magnetic surveys, in which detailed plans of entire villages have been compiled (Chapman *et al.* 2014b; Müller *et al.* 2016b).

Communal buildings can be identified first in the plans of early Cucuteni-Trypillia settlements from the 5th millennium BCE based on their size, architecture differing from living houses, and sometimes their separate location in the centre of the settlement (e.g. Baia) or at a plaza (Adancata). In these still small settlements, which cover areas of less than 2 ha, there exist usually only one detectable mega-structure, which presumably fulfilled communal functions for the entire community (Hofmann *et al.* 2016).

Linked to the process of colonisation of the areas east of the Prut and southern Bug, from 4250 BCE onwards a new type of settlement with a ring-shaped layout emerged. Some of these settlements were very large (20–60 ha) and obviously thoroughly planned before their construction. Their basic component was a circumferential main street (so-called “ring corridor”). Some of these settlements had very large central mega-structures, which, as in sites Zabolotne (37 ha, 305 and 912 m²) or Vilshanka (25 ha, 389 m²), were located in the inner row of houses of the ring corridor (Rud *et al.* in press), or, as in Vesely Kut (60 ha, 202 m²) and Chyzhivka (20 ha, 175 m²), were placed on plaza-like extensions of this main street (Hofmann and Shatilo in press-a).

The next developmental step was linked to the establishment of significantly larger settlements and mega-sites after 4000 BCE (up to 320 ha), especially in

the catchment area of the Sinyukha River east of the Southern Bug River. Here, in addition to central mega-structures, numerous smaller buildings now appear in the settlements, for example in Volodymyrivka, Nebelivka and Maidanetske, which apparently fulfilled communal functions for parts of the population. These buildings were clearly visible within the ring corridor, on the periphery of the settlements or on smaller plazas in the middle of residential areas in the inner zone of the settlements. In this phase, central mega-structures are usually placed in the centre of a specially created plaza, which was often located in the northeast of the settlement, where it adjoined the ring corridor.

In the further course of Trypillia settlements and mega-sites, from about 3800 BCE a decline in the number and size of small (decentralised) low-level mega-structures can be observed, followed by their complete disappearance from about 3700 BCE. In the mostly relatively small late Trypillian settlements (3600–3000 BCE), no communal buildings can be found anymore.

In some cases, excavations of low-level mega-structures in Dobrovody (Korvin-Piotrovskiy *et al.* 2015) and Maidanetske (Hofmann *et al.* 2019a), central mega-structures in Nebelivka (Gaydarska 2020) and Ozheve-Ostriv (Chernovol 2023), or a waste pit belonging to a central mega-structure in Stolniceni (Țerna *et al.* in press) provide detailed data on the architecture, find assemblages and function of the buildings. The architecture of the communal buildings differed significantly from contemporary house architecture in practically all cases, with smaller amounts of burnt clay, which is due to the lack of a *ploshadka*, a massive clay platform (Pickartz *et al.* 2019). The partially investigated mega-structure of Dobrovody (16 x 40 m) was a fenced area probably without roofing and with almost no finds and a multiphase clay installation (fireplace). The Mega-structure 3 in Maidanetske (18.0 x 8.6 m) was divided into two parts, a roofed part and an open courtyard, in which a variety of activities such as grain processing, textile production, food preparation and consumption are evidenced (Hofmann *et al.* 2019a). In terms of its composition and quantities, however, the inventory of the building hardly differed from the inventories of normal houses. In the covered part of this complex, there was a multi-phase clay installation (fireplace).

The possible mega-structure in Ozheve-Ostriv from the period before 4250 BCE was characterised not only by an extraordinary size (10 x 20 m), but also by a very

1 The term ‘mega-structure’ was originally defined for a central communal building in Nebelivka but later also applied to decentralised/peripheral communal buildings in Trypillia settlements. In contrast, the Nebelivka team, led

by Mykhailo Videiko, John Chapman and Biserka Gaydarska, uses the term ‘assembly house’ for decentralised communal buildings (see also Mischka *et al.* this volume).

comprehensive and rich find inventory compared to neighbouring buildings: In addition to a large quantity of flint, ceramics of all categories (including a large number of binocular vessels), a board game and tokens, workshops for the production of flint (weapons) and bone tools were found in this building. Therefore, the building was interpreted as a 'male house' or poly-functional communal workshop with domestic, ritual and military functions (Chernovol 2023).

The central mega-structure in Nebelivka (60x20 m) was significantly larger. It was also divided into a roofed and an unroofed part. The roofed part of the structure consisted of two smaller rooms in the east and a large 'central' room in the west. The latter had a long, low podium, which also occurs in a similar form in houses. Eight partly decorated clay platforms were located within the building. The mega-structure differed from residential buildings and low-level mega-structures by featuring multiple installations instead of only a single one. In addition to an extensive ceramic ensemble that contained slightly more open forms (dishes and plates) than other contexts, the inventory of the mega-structure differed from other contexts in, among other things, certain accumulations of tokens, house models, two fragments of game boards and a gold spiral (Gaydarska 2020, 378, 380). Furthermore, the inventory of the facility, similar to Mega-structure 3 in Maidanetske, provided evidence of a wide range of activities that were also witnessed in domestic contexts.

The evidence summarised above allowed to come to the following interpretation (Hofmann *et al.* 2019a): mega-structures in Trypillia were multifunctional integrative institutions, as frequently observed in non-ranked ethnographic contexts. Beyond individual households, these buildings were probably used at different levels of the communities for a variety of ritual and non-ritual activities, for formal and informal meetings, for the joint production and storage of certain goods, for the consumption of surpluses and joint decision making.

DATA AND METHODS

In order to contextualise the newly discovered public buildings in Trypillia settlements, we have recorded the remains of about 200 buildings for which possible public functions in the broadest sense (sacred, profane) have been postulated. The buildings date from about 10.000 to 3000 BCE in an area extending from Mesopotamia in present-day Iraq to the region north of the Alps (Fig. 2; Appendix 1). Due to the abundance of material, the collection is still incomplete and has exemplary character, particularly for Western Asia.

Associated with small communities, they were already deeply rooted in the 5th millennium BCE, but became increasingly important in the context of the formation of large aggregated Trypillian settlements and mega-sites. The accompanying multiplication of communal buildings in the largest of these communities was based on the amalgamation and integration of smaller communities into these mega-settlements, which retained their communal institutions. Together, these mega-structures formed a multi-level system of smaller decentral and larger central institutions that stood for the social and political constitution of these communities and enabled the political participation of larger sections of the population in communal activities and sequential decision-making processes. We interpret this configuration as an expression of a social constitution that was focused on the inner-communal balance of interests and the maintenance of social equality. We furthermore suspect that the resulting positive atmosphere provided the grounds for the pronounced innovativeness of these communities.

Judging by their declining number and size, decentral mega-structures lost more and more their importance from 3800 BCE onwards. This marginalisation of institutions at the lower levels can be regarded as a symptom of an increasing centralisation of decision-making in the hands of a smaller group of people. This process was probably accompanied by growing social inequality, which is manifested also in the increasing differences in house sizes (Hofmann *et al.* 2023). The concentration of particularly large houses along the first planned ring streets suggests that members of successful founder families might have been the main beneficiaries of this development (Schaefer-Di Maida *et al.* 2024, 300). This implies that the inhabitants of these settlements have apparently not been successful in their attempt to balance the interests and equal integration of newcomers. As a result, the settlements lost the appeal that had made them great in the beginning.

Using this sample, we are examining the temporal and spatial distribution of possible public buildings; the criteria that have led to the postulation of such buildings, in particular their identified public functions; the spatial integration of the buildings into the settlement (*e.g.* peripheral, central); their visibility in public space; possible indicators of a monumental character; and the size of the buildings that can provide clues to the size and composition of the user group. In line with architectural-sociological theories

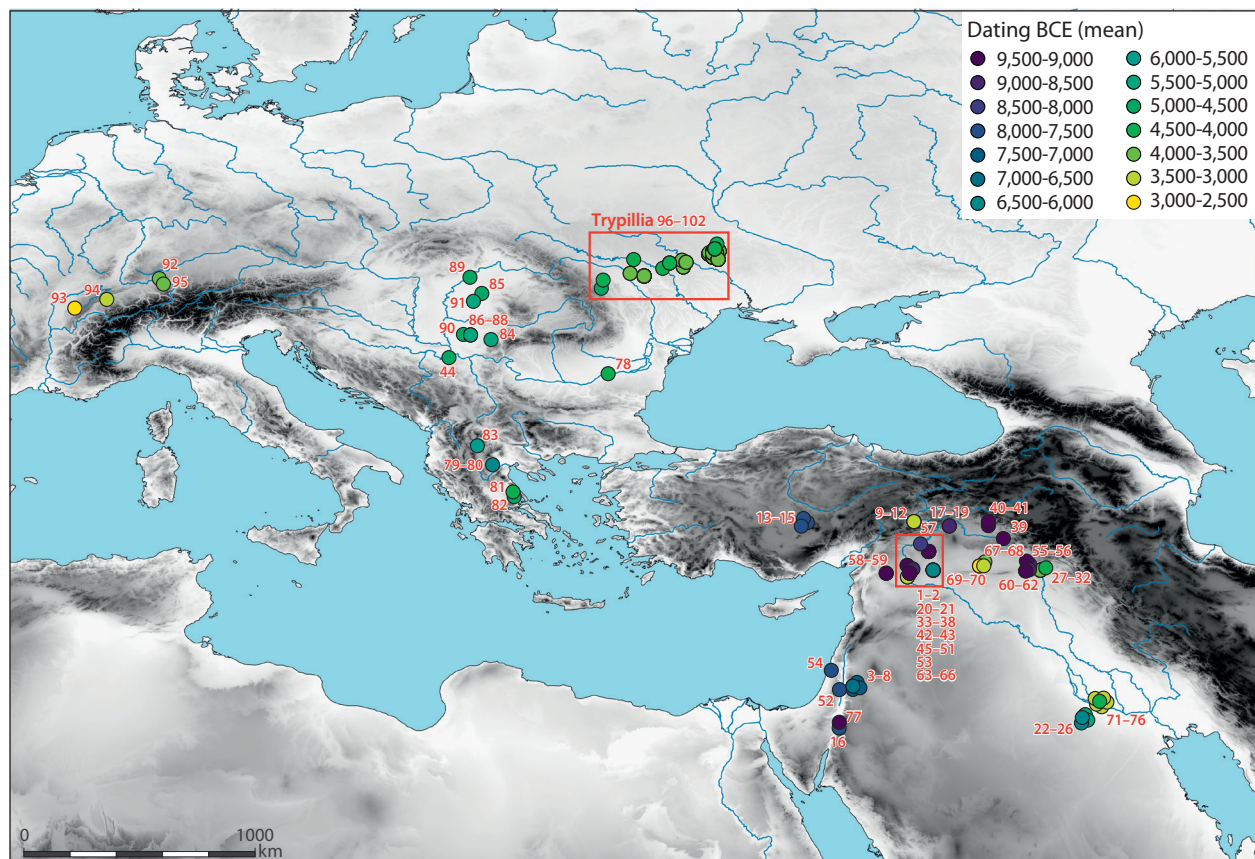


Fig. 2. Map showing the spatial distribution and dating of the sample of possible and certain public buildings considered in this article.

(e.g. Trebsche *et al.* 2010), we consider the centrality (in relation to the collectively used areas of a settlement), public visibility and (if given) monumentality of the architecture of communal buildings within settlement plans as important indicators for the importance of such building for strategies of gaining and maintaining political power in local communities.

In order to investigate the localisation and visibility of possible public buildings within settlements, around 200 settlement plans from south-eastern and eastern Europe are used, which have been compiled in other contexts (Hofmann *et al.* in press-a; Hofmann and Shatilo in press-b). On the basis of this sample, we explore the extent to which the anthropologically proven link between the complexity of socio-political organisation and community size (Johnson 1982) can be confirmed on the basis of the frequency and public visibility of potential communal buildings.

Estimating the size of the groups of people (in the following use group size), who regularly used communal buildings, we assume a space requirement of 2 m² per person, which is borrowed from comparable estimates (Düring 2006, 106). It should be noted that, due to internal subdivisions (e.g. partitioning of small side rooms), the actual floor area usable for assemblies in many of the buildings examined in this article is significantly smaller than the total dimensions of the buildings as recorded by us. The calculated use group sizes therefore represent only maximum values. For Trypillia-settlements use group sizes, derived from the dimensions of the mega-structures, can be related to population estimates, which are based on the number and sizes of houses (Müller *et al.* 2016a; Ohlrau 2020b; Müller *et al.* in press; Rud *et al.* in press; Hofmann and Shatilo in press-a).

ARCHAEOLOGICAL EVIDENCE

Western Asia

At least two types of communal buildings have been discovered in Western Asia for the period under investigation. The first one consists of numerous identified public buildings of the PPN (Pre-Pottery Neolithic, c. 9500–6400 BCE). Usually, they are labelled as communal buildings, special-purpose buildings or ritual buildings depending on the research tradition. However, reference was also made to the difficulties of distinguishing them from ‘normal’ residential buildings (Kinzel 2019). Various communal functions such as integrative community buildings, ritual or sacred functions, communal workshops, communal burial sites (e.g. el Hemmeth, Cayönü) or communal storage practices have been identified or assumed for them.

The second group of identified communal buildings is associated with the topic of formation processes of early states and centralised governance of ancient Mesopotamia (Frangipane 2007; Frangipane 2016).

PPNA-middle PPNB

The distinction between standard and special buildings in the Pre-Pottery Neolithic, according to a study conducted by Kemal Moetz for Upper Mesopotamia, is based on a set of criteria, including the size of the building, the construction of the floor, the presence of monoliths, ‘benches’, platforms, niches, and sculptures, a long, multiphase history of use and special treatment during the abandonment of such structures (Moetz 2014, 78–82). However, it should be noted that some of these elements also occur in domestic buildings (Kinzel 2024).

In a highly communal and possibly egalitarian context (Finlayson 2024), special buildings are particularly common in the early phases of Pre-pottery Neolithic A. In the context of the emergence of households and private spheres, their importance is decreasing beginning around 9000 BCE (Makarewicz and Finlayson 2018). In Upper Mesopotamia, buildings classified as special structures represent 12% of the total architecture in PPNA, remain common in Early/middle PPNB, and become less common in the Late PPNB and Pottery Neolithic (Moetz 2014, 65).

With regard to the size of the buildings, the phase between 9500 and 9000 BCE stands out due to some particularly large structures such as in Göbekli Tepe (Schmidt 2006; Structure C 700 m²; Building D 300 m²). However, as a result of a very long period of use from the 10th century until numerous conversions, the structures here show several concentric masonry rings, and the usable area therefore became smaller over time (Building C: c. 75 m²; Building D: c. 110 m²; Kinzel and Clare

2020). At other sites, usually the buildings are significantly smaller and vary between 7 and 180 m² with an average of 50 m² and a median of 44 m².

The special purpose buildings of the Western Asian Early Neolithic identified on the basis of the above criteria show a great variability in architectural terms and resemble in some aspects domestic architecture. Accordingly, they are initially round or oval structures, some of which were partially sunken, and which were gradually replaced by rectangular structures. Despite the formal similarity to domestic buildings, the architecture of special-purpose buildings was differentiated from other buildings very early on. Accordingly, as early as the 10th and 9th millennium BCE, we encounter special-purpose buildings with architecture that in some cases differs significantly from standard buildings, such as the structures at Göbekli Tepe, and the communal buildings of Çayönü and Nevalı Çori. The apsidal buildings at Ain Ghazal (Rollefson 1998) also differ considerably from contemporary residential architecture, but have been reinterpreted as possible granaries (Kujit 2010).

Suspected communal buildings of the Pre-Pottery Neolithic consist mainly of a single larger room and sometimes feature representative wall paintings (Cocquegniot 2010–2011), stone pillars with anthropomorphic characteristics and benches along the perimeter, which make it highly plausible that they were used as meeting rooms. In some cases, such as Jerf el Ahmar EA 30 (Stordeur *et al.* 2001), Çayönü, skull building or Ain Ghazal, PPNC ‘Special Building’ (Rollefson 1998), there are subdivisions by fixtures or partition walls that provided space for food storage, food preparation, but reduced the available usable area. In some sites, such as WF16 (southern Jordan) and Jerf el Ahmar (Syria), Building 37, communal buildings were surrounded by other small structures, including a small structure with a bead workshop. Within the settlement of Aşıklı Höyük, which dates from the first half of the 8th millennium (c. 7750 BCE), the complex building units HV and T were identified as communal buildings in which rooms partly with central fireplaces, columns and benches were grouped around quadratic courtyards.

Due to small excavation areas, only limited statements can be made regarding the placement of communal buildings within settlements. As far as can be determined, they were often located on the edge of public plazas, which could be either in the centre or on the periphery of the settlement. In Hallan Çemi (Zeder and Spitzer 2016), public buildings were located on the edge of the central plaza. The communal buildings of Çayönü were located on the southeastern slope of the

settlement, where there was also a plaza. The communal building of Nevali Çori was located on the edge of the settlement in an area separated by a wall.

Late PPNB and PN

For the period of the late PPNB and the Pottery Neolithic, there is little evidence in Western Asia for communal buildings up to the middle of the 6th millennium. Moreover, the architecture and size of these buildings present a heterogeneous picture and seems to have been more focused on the central management of storage than meetings to make joint decisions. A prominent example of a public building from this period is communal storage and archive Building II/III in Saby Abyad I (burnt village, operation 1, level 6, c. 6000 BCE), characterised by fourteen small square rooms, various installations and a furnace area. In addition to a large amount of burnt grain and grain processing tools, hundreds of seals, tokens and figurines were found in the building (Akkermans and Verhoeven 1995; Akkermans and van der Plicht 2014; Graeber and Wengrow 2021). From an architectural perspective comparable is the irregular building complex I in the same site (operation 1, level 3) from around 5900 BCE, which consists of more than 14 rather small rooms (Verhoeven *et al.* 1996). It was architecturally accentuated by a representative facade with vertical niches. Public functions, not further defined, were assumed also for the rectangular Building XI in Khirbet esh-Shenef, which was equipped as well with a niched facade and dates from around 5550 BCE (37 m²) (Akkermans and Wittmann 1993). On the basis of their location underneath later temple buildings, several smaller buildings from levels XVI (7.6 m²) and XV (c. 60 m²) at Tell Eridu (c. 6100 BCE), southern Iraq, have been interpreted as possible proto-temples, although there is no continuous sequence of buildings in the stratigraphy and these buildings also differ significantly from later temples in their ground plans (Safar *et al.* 1981).

Ubaid and Uruk

Reliable evidence of buildings designated as 'temples' dates back to the second half of the 6th millennium and the 5th millennium in the Ubaid period (Stein 1994; Nissen 2012, 38–39). The relatively standardised floor plans of this group of buildings represent variations of the tripartite domestic buildings that have been documented since the Ubaid period (Nissen 2012; Roaf 2013). They have a larger central room, which is adjoined by smaller rooms on both sides along the longitudinal axis. Because of their floor plan, which is practically identical to that of residential buildings, they are understood as monumental households that resemble 'representative structures' of a political leadership that may have had both secular and ritual

functions (Ur 2014). These early 'temples' were often built in segregated areas on elevated artificial platforms, early forms of the ziggurat, and often had central installations that have been interpreted as altars or sacrificial tables, as well as more elaborate facade designs with corner risalits, niches created by vertical wall projections and mosaics composed of fired clay nails. Stratigraphic sequences or individual evidence of such buildings have been found, for example, at Tell Eridu (starting around 5200 BCE, Tepe Gawra (starting around 4500 BCE) and Uruk (c. 4125 BCE). The size of the buildings mentioned varies between 90 and 280 m², although the usable internal area for meetings is usually significantly smaller due to internal subdivisions.

This very specific and relatively standardised public architecture continued to flourish during the subsequent Uruk period in the late 5th and 4th millennium BCE, but no longer concerned only suspected temples, but also other public buildings such as the ceremonial Building 37 in Arslantepe, the 'Feasting Hall' in Tell Brak or the functionally probably differentiated buildings of the Eanna district in Uruk. Smaller buildings cover areas between 125 and 400 m². Larger buildings, such as Buildings C and E, the limestone building and the stone peg building in the city of Uruk, reach enormous sizes between 1100 and 3150 m².

Southeast Europe and Pannonian Plain

Compared to Western Asia, the evidence for communal buildings in south-eastern Europe and the Pannonian Plain is in many cases at least ambiguous. As already mentioned, its interpretation has long been focused on the identification of ritual or sacred contexts. Buildings that appeared to be different from ordinary dwellings because of their size, central location within the settlement, furnishings, decoration and finds were often interpreted synonymously as temples, sanctuaries, shrines or alternatively as buildings for special purposes, e.g. in the context of communal rituals. Such buildings were identified in various regions of south-east Europe from the late 7th to the end of the 5th millennium BCE, e.g. in Berettyóújfalu-Herpály (Raczky *et al.* 2020), Căscioarele-Ostrovel (Lazarovici and Lazarovici 2006, 534–543), Jakovo-Kormadin (Jovanović 1991), Nea Nikomedia (Souvatzi 2008, 63–76), Parța (Lazarovici and Lazarovici 2006, 300–337), Polgár-Csőszhalom (Raczky and Sebők 2014), Uivar-Gomila (Drașovean and Schier 2010), Vésztő Mágor (Hegedüs and Makkay 1990), Vrbjanska Čuka (Kitanovski *et al.* 1990).

The aforementioned evidence has already been critically evaluated in detail by Clemens Lichter, particularly with regard to religious interpretations (Lichter 2014). Based on a detailed knowledge of Neolithic architecture

in south-eastern Europe (Lichter 1993), he believes that the criterion of size cannot be applied to the buildings in question, as this lies within the general variability of buildings of this period and other factors (e.g. household size, household wealth) may also be responsible for the deviations.

The size of the buildings included in our sample varies between 32.5–183.0 m² with a mean of 92.0 m² and a median of 72.6 m². In most cases, the floor plans and construction methods of the buildings in question do not clearly differ from domestic architecture: There are single and multi-roomed structures, many of which were furnished with normal domestic installations such as domed ovens, grain grinders, fireplaces and storage boxes. A box-shaped installation in House 1 of Vrbjanska Čuka, which was originally interpreted as an altar, has recently been re-interpreted as granary. The ‘altar’ in House 1 in Jakovo-Kormadin could also have been an installation with a similar function.

Symbolic finds and preserved decorations play a paramount role as criteria for the identification of supposedly sacred buildings: these include large sculptures such as in Parta, house models (e.g. in Cascioarele, Madzari, Vésztő-Mágor), bucrania and wall decorations (Căscioarele-Ostrovel).

The frequently applied criterion of a central location of communal buildings within settlements can only partly be verified. Thus, in south-eastern Europe and the Pannonian Plain, a central location is given in some cases, e.g. for the postulated communal buildings in Parta and House 11 in Polgár-Csőszhalom and House 11 in Berettyóújfalu-Herpály, which are located on small tells within larger flat settlements. In other cases, such as Uivar, the buildings in question were located outside the centre of the settlement or their location within the settlement cannot be assessed.

A generally better criterion seems to be the position within the public space of a settlement. Such a case exists, for example, in the Late Neolithic settlement of Sesklo, where a large building (so-called “megaron”) was placed in an open space in the centre of the settlement. A central building was also found in Palioskala (Toufexis 2016), but it was integrated into a concentric layout characterised by dense housing.

The ambiguous character of many evidences for communal buildings in south-eastern Europe and the Pannonian Plain in the Neolithic could be partly explained through the lack of an obvious (detectable) specific architecture of such buildings. So, there was little room to set apart communal buildings and associated social institutions, the existence of which would be entirely plausible from an anthropological perspective in aggregated settlements of the Late Neolithic, for example, architecturally. Thus it can be difficult to detect such houses. In addition, it also is generally very plausible that

open spaces, e.g. in the interior of centripetal layouts (Hofmann *et al.* 2019b), on small spatially separated tells (Gyucha *et al.* 2022) or ditch structures such as rondels (Řídký *et al.* 2019), were associated with certain communal functions. However, as explained above, such types of public facilities were excluded from this study.

Central Europe

Probably due to the generally less favourable conditions for the preservation of architectural remains, assumed public buildings in Central Europe are rare. Instead, structures such as rondels and other ditch systems are proposed to have been places with public functions. As for houses, below are some examples of excavated buildings with supposed public functions.

Large houses with storage platforms of the Linearbandkeramik (LBK) were assumed to have public functions for communal grain storage (Coudart 2015), although these could also reflect social differentiation within these early Neolithic communities (Hofmann and Lenneis 2017).

Relatively small so-called “cult houses” in Bodman-Ludwigshafen (also: Ludwigshafen Seehalde, c. 3860 BCE) and Sipplingen-Osthafen (B; c. 3840 BCE) were placed in a ritual context and are characterised by painted and plastic wall decorations depicting females (Schlichtherle 2016). In both cases, the buildings were located on the lakeside edge of the settlement, spatially undifferentiated from other houses.

Communal functions were assumed for a building spatially separated from other houses and located on the periphery of the village in site 19 at Lake Châlain (French Jura) (c. 3000 BCE). It was characterised by a construction with four parallel rows of posts and an extensive inventory of finds, including loom weights, large quantities of grain and achenes (nutlike indehiscent fruits), a fishing net and a wooden sledge with a yoke (Vielle 2002).

A very impressive sequence of three public buildings, erected in an area of the settlement free of houses on an artificial platform were found in the Marin-Les Piécettes NE (c. 3500 BCE) (Honegger 2007). As a clear indication for the non-domestic character of these buildings, find distribution analyses show the absence of artefact categories close to these buildings that are widespread elsewhere in the settlement. The prominent location of the building indicates its central function for the settlement.

Although the overall evidence is limited, the examples show that such buildings also existed in Central Europe, although they are often difficult to detect. A certain accumulation of possible ‘special buildings’ in the well-researched north Alpine lakeshore settlements

seems to reflect the special preservation conditions of architectural remains and the research strategies

applied there, which, for example, include very precise dating and intra-site find mapping as standards.

DIFFERENT 'SPECIAL' BUILDINGS ASPECTS

One of the most important prerequisites for defining 'special' buildings in an archaeological context is their distinction from residential houses (Fig. 3). This

concern both the architecture and the characteristics of use, as well as the functions that can be traced.

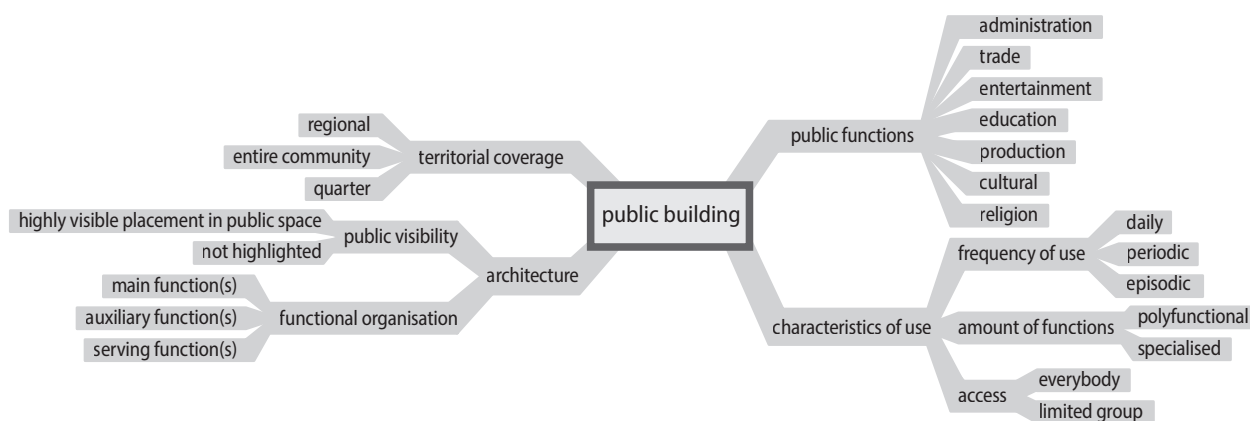


Fig. 3. Schematic representation of aspects relevant for the analysis of public buildings.

Communal functions

As it can be seen the identification of public and special-purpose buildings in the archaeological context proves to be a difficult problem to solve, which is often handled unsystematically and which might lead to questionable or mono-functional classifications. Functional classifications of communal buildings are partly guided more by broader ideas than evidences as it appears to be the case in both European (Lichter 2014) and Western Asian (Nissen 2012, 190–193) temples. On the one hand, there seems to be a certain consensus in Western Asian archaeology that just a few structural features are sufficient to identify a 'temple' building (*ibid.*, 38). On the other hand, it has been suggested that the word 'temple' in pre-literate times represented an umbrella term for various types of communal buildings whose functions are not or only incompletely known (Nissen 2013). Accordingly, some buildings are being reconstructed as having functions other than religious ones, even though their architecture might fulfil the criteria for temple buildings (e.g. Building 37 in Arslantepe: Frangipane 2016).

In view of the probably closely interwoven mundane and ritual spheres (Bradley 2005), the existence of specialised buildings, such as the often-postulated religious architecture of cult houses, temples, or sanctuaries, is rather unlikely or hard provable for the

non-literate societies. It therefore seems more appropriate to assume more general 'integrative' or communal functions', as they include both a wide range of activities (including religious practices or cults).

In our view, ideally, combinations of complementary criteria should be used to identify communal buildings and to reconstruct their functional profiles: The architecture, *i.e.* size, spatial arrangement, decoration, furnishings and public visibility, plays an extremely important role, since the design of the architecture and the furnishings often provide clues as to the extent to which the buildings were suitable for meetings, storage or other purposes. Indications of this are for example the space available, floor plans (room arrangement) and installations such as fireplaces, benches, podiums or altars, *etc.* To identify communal buildings, it is, additionally, crucial to what extent these parameters deviate from the 'norm' of standard buildings for living.

On the other hand, composition and density of artefact assemblages provide alternative or supplementary criteria for the identification of communal buildings, again in relation to 'normal' buildings. Indicators of public buildings include, for example, the absence of objects from the domestic context, the association with unusually large or composited groups of burials (e.g. Makarewicz and Rose 2011) or the accumulation of symbolic objects that are considered unusual (Ebersbach 2010). The dimensions of such objects, such as the

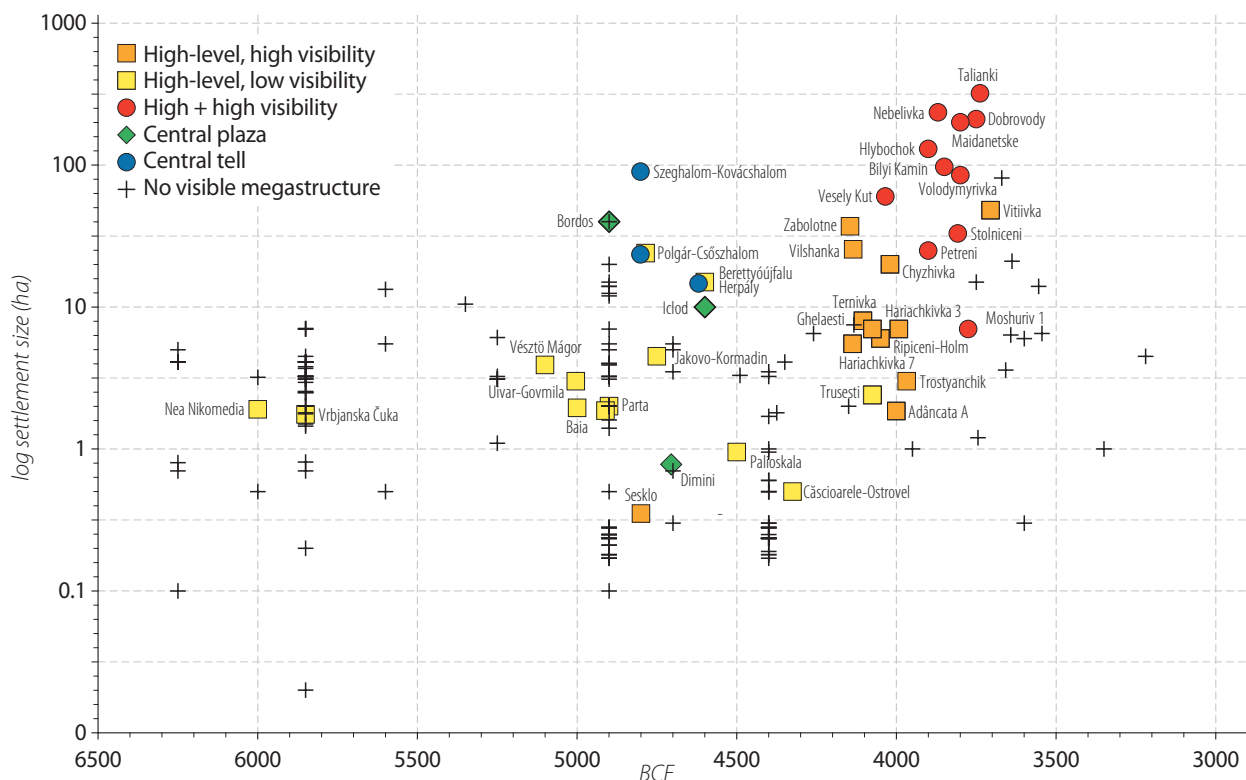


Fig. 4. Scatter diagram showing the chronological distribution (x-axis) of settlements with possible and certain public buildings in southeastern and eastern Europe in relation to the size of the settlement (y-axis). Symbols show classifications of different public visibilities and high and low-level mega-structures. Only sites with visible mega-structures are labelled.

occurrence of large sculptures, also play an important role as an indicator of communal functions (Rollefson 1998). A lack of finds are seen as possible indicators of non-domestic contexts as less waste was produced due to lower intensities of use or the space was cleaned more often or thoroughly (Ebersbach 2010). In other contexts, a particularly high density of artefacts was considered a feature of communal buildings (Chernovol 2023).

The functional profiles of the buildings that can be deduced from find inventories often differ greatly between and within the regions under investigation. For example, in the Trypillian context different multifunctional profiles of mega-structures were observed that includes daily activities, special production (e.g. Maidanetske — grain processing, Ozhevo — flint, bone and leather), possibly educational and religious functions (Chernovol 2023). The three territorially and chronologically close settlements Talianki, Dobrovody, and Maidanetske demonstrate quite different patterns: in Talianki, obvious large mega-structures in the ring street are missing in the plan; in Dobrovody, there is almost no archaeological find materials in the excavated structure, in contrast to the already described mega-structure from Maidanetske (Korvin-Piotrovskiy *et al.* 2015). It is noteworthy that for several mega-structures from Ozhevo and Nebelivka, game boards,

otherwise rare for Trypillian contexts, are known. In addition to these sites, they were found only in Talianki, but there in residential buildings. Thus, it is possible that ‘entertainment’ or ‘divination’ activities associated with such boards (see Shatilo 2015) have been moved to some residential houses in Talianki.

Territorial coverage, use group size and dimensions of communal buildings

In accordance with the ethnographic record of pre-state non-ranked societies, Trypillia mega-structures demonstrate very clearly that communal buildings existed within settlements for different groups of users, which included, for example, entire communities or only certain parts of them.

The analysed sample of settlement plans from South-eastern and Eastern Europe shows that the variability and visibility of communal buildings increases with the size of the settlement but show also regional variability. On the one hand, there is a spatial differentiation between settlements in the Balkans, the Pannonian Plain and the region east of the Carpathians (Fig. 4). In the Balkans, postulated communal buildings occur in settlements from a size of 0.5 ha, but are

usually not architecturally differentiated from residential buildings and not clearly visible in settlement plans. The situation is different in the Pannonian Plain, where in some cases small tells have been identified as communal spaces partly with possible communal buildings within large horizontal settlements (>10 ha). In the region east of the Carpathians, communal buildings were much more visible, even in very small settlements of at least one hectare in size. Communities with several levels of communal buildings occur exclusively in Trypillia settlements with a size of 30 ha or more. The only exception is the relatively small settlement of Moshuriv 1 (7 ha), whose population probably fissioned from the population of the mega-sites (Hofmann *et al.* in press-b).

Consequently, in accordance with anthropological research, the size of settlements represented an important factor for the social configuration and the number of organisational levels within communities, which is partly visibly manifested in the record of communal buildings. Clear regional differences in the size of

settlements within the network of Trypillia communities might be explained by different forms of social organisation: A multiple-level system of communal institutions was primarily found to be associated with the largest Trypillia mega-sites, while the lower levels of communal buildings seem to be largely absent in other regions. In consequence, the configuration of the socio-political system might have been a possible limiting factor for the size of communities. It should be noted that evidence of low-level communal buildings was also found in the comparatively small settlement of Stolniceni 1 (33 ha) (Terna *et al.* in press). However, these are located in the rows of houses in the ring corridor in the settlement plan and are therefore less visible.

In the sample investigated, the estimated maximum use group sizes for possible communal buildings vary considerably for the different periods and regions (Table 1). They are lowest for the Neolithic of Central Europe, Southeastern Europe and Western Asia and highest in the Uruk and Trypillia periods.

Table 1. Comparison of maximum use group sizes of communal buildings based on floor area sizes.

Context	Sample size	Maximum use group size	Mean	Median
Western Asia, Pre-Pottery Neolithic	37	3–350	41	22
Western Asia, Pottery Neolithic	6	4–50	31	33
Western Asia, Ubaid	5	45–140	90	80
Western Asia, Uruk	18	60–1575	310	102
Southeastern Europe, Neolithic	14	16–91	31	33
Trypillia, high level	27	88–600	192	156
Trypillia, low level	71	46–605	135	100
Central Europe, Neolithic	3	12–24	18	18

Assuming that all communal buildings are identified in magnetic plans, for some Trypillian settlements the percentage of the total population that could have participated directly in the activities in mega-structures can be estimated based on their floor size (Table 2; Fig. 5). The parameters of the analyses are the floor area of the communal buildings which are set in relation to estimates of the population sizes based on the number and size of houses. In early settlements from the period before 4000 BCE with only central mega-structures, a relatively high proportion of the population, between 45 and 90%, could potentially directly participate in decision-making. With the establishment of the system with high- and low-level mega-structures, this proportion increased to between 80% and 100% between 4000 and 3800 BCE. Along with the gradual decline in the importance of low-level mega-structures, the possible total use group size decreased dramatically to 10–30% after 3800 BCE. Even though these estimates

certainly only reflect general trends, they clearly show the enormous centralisation of participation in communal activities and decision-making processes. This centralisation was accompanied by a significant increase in social inequality (Hofmann *et al.* 2023) and the acceleration of disintegration processes of the mega-sites (Hofmann and Shatilo 2022). We conclude from this dynamic that the communal buildings of Trypillia settlements and the institutions behind them were an integral part of the social constitution and political balance of power of these unique communities (Müller *et al.* 2018).

Intra-communal segmentation, as evidenced by mega-structures in Trypillia settlements, is also evident in other cases. This applies to the Pre-Pottery Neolithic, where, for example, the simultaneous use of several 'collective' buildings has been demonstrated at Göbekli Tepe (Kinzel and Clare 2020).

Table 2. Use group sizes of public buildings of Trypillia settlements in relation to the total size of the communities. Estimated population sizes (according to Ohlrau 2020a; Rud et al. in press; Hofmann and Shatilo in press-a) and estimated maximum use group sizes determined for each building category by dividing the summed floor area of public buildings by the assumed minimum space requirement per person of 2 m².

Site	Type	Dating max.	Dating min.	Dating mean	Population min.	Population max.	Max. use group size high-level	High level % min	High level % max	High level % mean	max. use group size low-level	Proportion of the settlement area examined by magnetic survey	Max. use group size low-level (scaled up to 100% settlement area)	Low level % min.	Low level % max.	low level % mean	High/low level % mean
Dobrovody	high(?) + low	3800	3700	3750	5863	11292				?	1143	11	10391	10	27	18.5	19
Hariachkivka 3	high	4220	4050	4135	196	343	290	85	100	93	0						93
Hariachkivka 7	high	4230	4050	4140	160	280	171	61	100	81	0						81
Hariachkivka 8	high	4330	4050	4190	270	473	252	53	93	73	0						73
Maidaneske	high + low	3950	3650	3800	5538	10665				?	1514	82	1850	17	33	25.0	25
Nebelivka	high + low	3970	3770	3870	2589	4987	600	12	23	18	2915	100	2915	58	100	79.0	79
Talianki	high(?) + low	3945	3530	3738	4158	8008				?	738	55	1341	17	32	24.5	25
Ternivka	high	4220	3990	4105	4105	259	159	61	100	81	0		0				81
Vesely Kut	high + low(?)	4070	4000	4035	870	1675	101	6	12	9	324	50	648	39	75	57.0	57
Vilshanka	high	4220	4050	4135	286	501	195	39	68	54	0		0				54
Volodymyrivka	high + low	3920	3800	3860	1584	3050	221	7	14	11	1718	25	6872	100	100	100.0	100
Zabolotne	high	4250	4040	4145	1050	1838	608	33	58	46	0		0				46

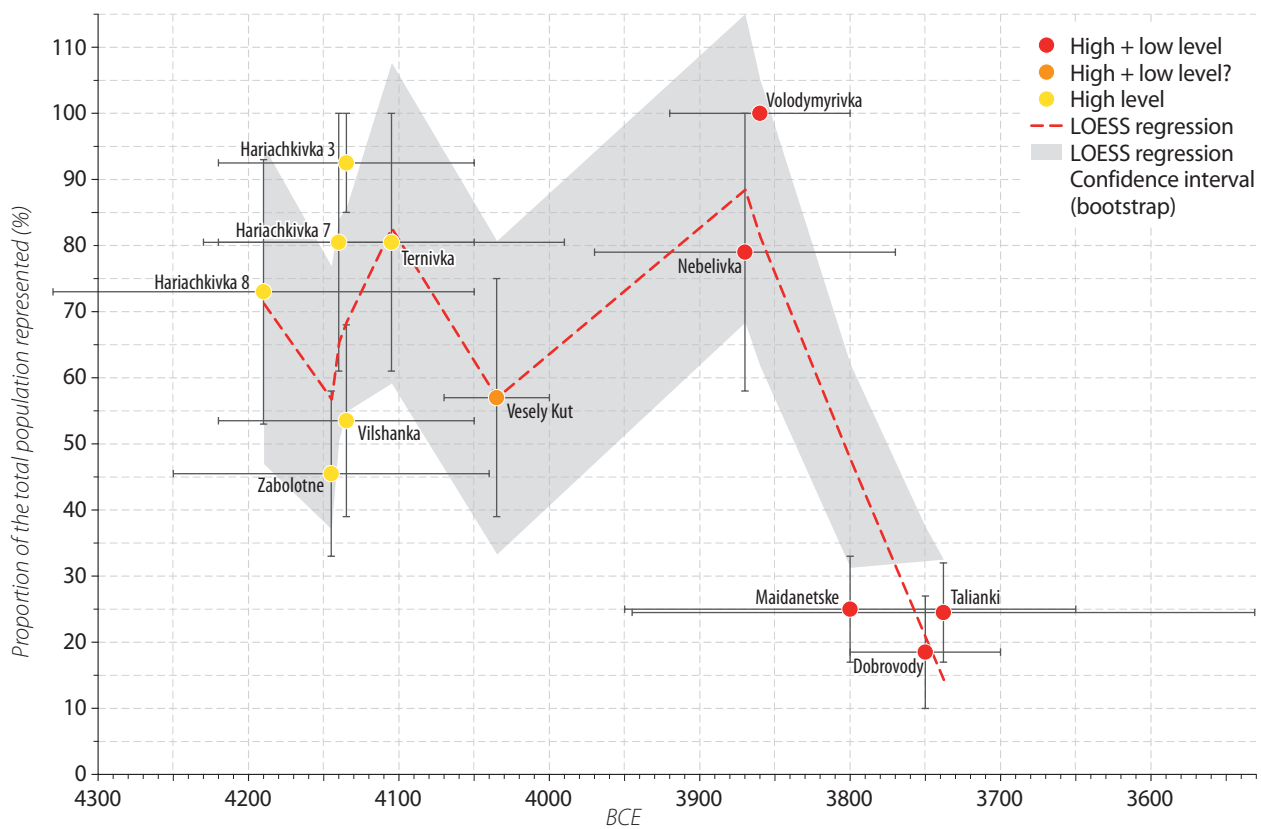


Fig. 5. Proportion of the population that may have been involved in events in mega-structures. The trend is shown using LOESS regression.

Architecture and monumentality of communal buildings

The architecture of public buildings includes visual perception, visibility, interior and exterior decoration, together with the functional division. The sample contains very different examples of how public buildings differ architecturally from residential ones:

It is often pointed out that the architecture of communal buildings of the Pre-Pottery Neolithic and also of Ubaid and Uruk buildings developed from contemporary residential architecture (e.g. Kinzel 2024; Roaf 2013), which was adapted to the specific requirements by adding certain elements such as pillars, niches and platforms. Correspondingly, it is partly difficult to clearly distinguish between 'special' and 'domestic' buildings (e.g. Kinzel 2019).

In Ubaid and Uruk communal buildings, the architecture increasingly differed from residential buildings, recognisable through more complex floor plans and more representative façade designs and artificial platforms.

In Central and Western Europe no independent communal architecture has been identified so far and postulated communal buildings are practically impossible to distinguish from residential houses.

Architecture of Trypillia mega-structures, reconstructed by magnetic plans and excavations, show the simultaneous existence of different building types which differ in terms of the length-width ratios of their floor plans, their subdivision in the longitudinal direction, internal features and different degrees of roofing (Hofmann *et al.* 2019a). Excavated mega-structures do not yet cover the full range of this variability. The buildings in Nebelivka, Dobrovody and Maidanetske, differed fundamentally from contemporary residential houses in terms of their floor plans and construction. However, their interior furnishings borrowed certain elements from them, such as podiums along the longitudinal walls and central platforms/installations (fire-places).

Visual perception is also varied and correlates with the above-mentioned observations. It includes monumentality and/or certain spatial placement, due to which the effect of emphasis of the building in the landscape is created. Visual perception could be used to demonstrate the importance of the architecture and of the institutions associated with them to the users.

The communal architecture of Western Asia from the late 6th millennium BCE was emphasised by more elaborate niched façade designs and later by decorations and an elevated construction method on artificial platforms. This is particularly evident in the Ziggurat-like constructions, which represented an enormous communal construction effort and got later extreme

dimensions in the buildings of the Eanna district in Uruk.

Monumental effects were also intended for Trypillia mega-structures achieved by the highly visible placement of the buildings in public spaces: Some central mega-structures, such as those in Bilyi Kamin (Rud *et al.* 2019) or Petreni (Rassmann *et al.* 2014), were placed on topographically particularly visible points in the terrain and were therefore visible from afar. Mega-structure 3 in Maidanetske might have been built on an artificial platform in the midst of the main street of the settlement (Dreibrodt *et al.* in press).

In the case of the PPN buildings, some of which were constructed in a sunken manner, visual perception effects seem to particularly affect the impressive interior, which was frequently emphasised by T-shaped pillars with pictorial programmes.

Thus, in terms of the effort required for construction and the intended architectural effects, there are considerable differences in communal architecture over time and space, which led to a different public visibility of these institutions.

Where, when and why special buildings were built or became visible?

As figure 6 suggests, public buildings may have existed in practically all periods, although in Western Asia the evidence of the 7th and 6th millennium is clearly less than before and after. A spatial gap in Anatolia was explained with a possible greater similarity of communal buildings to domestic structures (Özdoğan and Özdoğan 1998), but could also be partly due to the incompleteness of the examined sample. The situation in Anatolia thus resembles that in south-eastern and central Europe, where it is often difficult to verify the public character of presumed communal buildings. Consequently, functions, visibility and significance of such structures seem to vary greatly within this vast study area and over this long period of time. However, in very different historical situations, there seems to be an increased visibility of these buildings in connection with monumental manifestations.

We could therefore ask when communal buildings become visible: Several contexts with different historical connotations and trajectories are of interest in this respect: For example, in Trypillia communities such buildings are part of a system for maintaining social balance and are very strongly expressed in their external appearance. Together with the ring-street, which provides for the majority of the inhabitants of the settlement equal access to structural site components, they symbolise the ideology of these communities, which was geared towards maintaining social

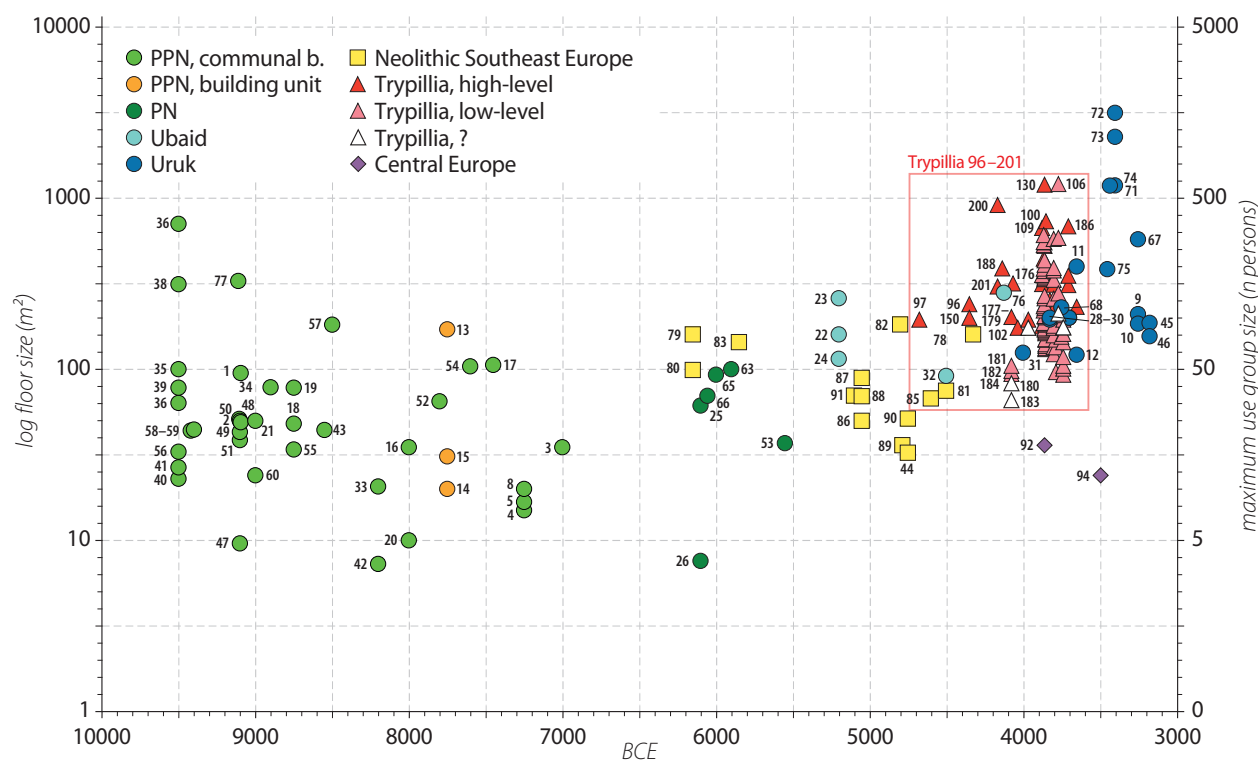


Fig. 6. Floor areas and estimated use group sizes (y-axis) of the suspected and secure public buildings considered in this article on the time axis (x-axis).

equality and arose in the context of the colonisation of the Northwest Pontic forest-steppe zone. In daily life, they could fulfill a variety of integrative purposes, including both ritual and non-ritual activities, joint decision-making, and the storage and consumption of surplus.

By contrast, the more inward-looking design of community buildings of the Pre-Pottery Neolithic could be due to the fact that they served to a large extent to maintain the cohesion of the communities. Rooted in the Natufien, communal buildings of this period are closely associated with a community-oriented ideology and at the same time focus of daily social interaction and various economic activities (Finlayson 2024).

The three-part buildings of the Ubaid period designated as 'temples' were publicly visible in the context of the formation of a large interaction sphere spanning large parts of Mesopotamia, which was initially characterized by settlement systems with moderate community sizes (e.g. Stein 1994). They underwent further uninterrupted elaboration in the enormous population concentrations of the Uruk period, along with growing social complexity and social differentiation (Frangipane 2016; Basri and Lawrence 2020). The remarkable architectural similarity of these 'temples' to the three-part floor plans of large institutionalized households blurs their significance as primarily religious buildings

and has triggered an ongoing discussion of possible secular functions as 'prestigious structures of political elites' in the context of increasing social differentiation (Ur 2014). The repetition and further development of the same floor plan types over long periods of time and the repeated construction of the buildings in the same place show that they were apparently intended to emphasize institutional continuity.

This means that different historical situations lead to visible public buildings. In the case of South-eastern and Central Europe, it is not so simple. Here communal buildings are not always visible, which may be due to the smaller size of the communities which required not this large ideological effort like in other contexts.

Consequently, the overarching reasons for the establishment of highly visible public buildings seems to have been at least twofold: On the one hand, the observed interplay between local population sizes and the increase in the number of levels of political decision-making and social integration, for example in Trypillia communities, suggests that the buildings played an important role in reducing social stress. However, it seems much more important that they on the other hand, served to support and to elaborate the ideological foundations of societies, which were necessary for the establishment and maintenance of various social, economic and political forms of organisation.

CONCLUSION

The evaluation of possible communal buildings in a working area stretching from the northern foothills of the Alps to the Persian Gulf between the 10th and 4th millennium BCE shows a great variety of architecture, functions, visibility and significance of such public facilities. While in some periods and regions (e.g. central and south-eastern Europe) it is difficult to verify the public character of possible communal buildings, in other contexts they emerge with great clarity and are visibly emphasised. The latter cases concerned largely social settings where there was apparently an increased need for ideological underpinning of

newly established forms of social coexistence and political forms of organisation. This concerns for example Trypillia mega-sites communities in today's Ukraine and Moldova where such buildings supported a distinct ideology of equality. While communal architecture is thus in some cases a mean of displaying ideologies, in others it is not. In the latter situations, in which the architecture of possible public buildings is not clearly differentiated from domestic architecture, it is sometimes much more difficult to determine the extent to which public buildings existed.

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APPENDIX

Appendix 1 (continued on the following pages). Data list of the building structures discussed in this article, including category, settlement size, building size, and reference.

Id	Site	Building	Category	Size (ha)	Dating	Floor (m ²)	L. (m)	W. (m)	Dia. (m)	Reference
1	Abr 3	B2	PPN, special building		9095±165	95.00			11.00	Moetz 2014
2	Abr 3	M1	PPN, special building		9095±165	49.00			7.90	Moetz 2014
3	Ain Ghazal	PPNC 'Special buiding'	PPN, special building	14.00	7000±170	35.00	>6.00	3.50		Rollefson 1998
4	Ain Ghazal	Apsidal building (central field)	PPN, special building	14.00	7250±350	15.00	4.50	3.50		Rollefson 1998
5	Ain Ghazal	Apsidal building (Eastfield)	PPN, special building	14.00	7250±350	16.80	4.80	3.50		Rollefson 1998
6	Ain Ghazal	Apsidal building (North Field 1–2)	PPN, special building	14.00	7250±350					Rollefson 1998
7	Ain Ghazal	Apsidal building (North Field 3)	PPN, special building	14.00	7250±350		5.00			Rollefson 1998
8	Ain Ghazal	LPPNB 'Special buiding'	PPN, special building	14.00	7250±350	20.00	>5.00	4.00		Rollefson 1998
9	Arsilantepe	Building 37	Uruk, temple/special building	2.40	3250±150	210.00	>16.00	13.20		Frangipane 2016
10	Arsilantepe	Temple B	Uruk, temple/special building	2.40	3250±150	185.00	14.40	12.80		Frangipane 2016
11	Arsilantepe	Temple C	Uruk, temple/special building	2.40	3650±150	399.00	21.00	19.00		Frangipane 2016
12	Arsilantepe	Temple D	Uruk, temple/special building	2.40	3650±150	121.50	>15.00	>8.10		Frangipane 2016
13	Aşıklı Höyük	Court HV	PPN, building unit	4.00	7750±250	171.00				Düring 2006
14	Aşıklı Höyük	Court MI	PPN, building unit	4.00	7750±250	20.00				Düring 2006
15	Aşıklı Höyük	Court T	PPN, building unit	4.00	7750±250	31.00	5.50	5.50		Düring 2006
16	Beidha A	Building 37	PPN, special building	0.40	8000±0	35.00			6.75	Makarewicz and Finlayson 2018
17	Çayönü	Terazzo-building	PPN, special building	3.14	7450±100	106.00	11.75	9.00		Moetz 2014
18	Çayönü	Flagstone-building	PPN, special building	3.14	8750±250	48.15	10.70	4.50		Moetz 2014
19	Çayönü	Skull-building	PPN, special building	3.14	8750±250	78.00	9.70	8.00		Moetz 2014

Id	Site	Building	Category	Size (ha)	Dating	Floor (m ²)	L. (m)	W. (m)	Dia. (m)	Reference
20	Dja'de al-Mughara	House of the dead	PPN, special building		8000±0	10.00	>3.20	3.20		Coqueugniot 2010–2011
21	Dja'de al-Mughara	Bâtiment communautaire	PPN, special building		9000±0	50.00			8.00	Coqueugniot 2010–2011
22	Eridu	Temple Level IX	Obaid, temple/special building	25.00	5200±200	160.00	>14.60	11.00		Safar <i>et al.</i> 1981
23	Eridu	Temple Level VIII	Obaid, temple/special building	25.00	5200±200	260.00	18.70	14.00		Safar <i>et al.</i> 1981
24	Eridu	Temple Level XI	Obaid, temple/special building	25.00	5200±200	115.00	14.80	7.80		Safar <i>et al.</i> 1981
25	Eridu	Proto-Temple Level XV	Obaid, prototemple?	25.00	6100±300	61.30	8.40	7.30		Safar <i>et al.</i> 1981
26	Eridu	Proto-Temple Level XVI	Obaid, prototemple?	25.00	6100±300	7.60	3.10	3.10		Safar <i>et al.</i> 1981
27	Gawra Tepe	Temple Level VIIIA	Uruk, temple/special building	2.00	3700±50	200.00	>15.25	12.00		Rothman 2009
28	Gawra Tepe	'West Temple' Level VIIIC	Uruk, temple/special building	2.00	3700±50	200.00	16.25	12.50		Rothman 2009
29	Gawra Tepe	Temple Level IX	Uruk, temple/special building	2.00	3825±75	195.00	12.50	15.50		Rothman 2009
30	Gawra Tepe	Temple Level X	Uruk, temple/special building	2.00	3825±75	200.00	11.40	17.20		Rothman 2009
31	Gawra Tepe	Temple Level XI/XA	Uruk, temple/special building	2.00	4000±100	125.00	40.00	40.00		Rothman 2009
32	Gawra Tepe	'Temple' XIII North	Obaid, temple/special building	2.00	4500±100	91.40	11.25	8.13		Rothman 2009
33	Göbekli Tepe	Lion pillar building	PPN, special building	9.00	8200±600	20.64	5.80	4.30		Moetz 2014
34	Göbekli Tepe	Structure E	PPN, special building	9.00	8900±1300	78.54			10.00	Moetz 2014
35	Göbekli Tepe	Structure A	PPN, special building	9.00	9500±700	100.00	10.00	10.00	10.00	Moetz 2014
36	Göbekli Tepe	Structure B	PPN, special building	9.00	9500±700	63.62			9.00	Moetz 2014
36	Göbekli Tepe	Structure C	PPN, special building	9.00	9500±700	706.90			30.00	Moetz 2014
38	Göbekli Tepe	Structure D	PPN, special building	9.00	9500±700	314.16			20.00	Moetz 2014
39	Güzir Höyük (Gusir Höyük)	Large building	PPN, special building	3.50	9500±700	78.00			10.00	Moetz 2014
40	Hallan Çemi Tepesi	Building A	PPN, special building		9500±700	22.90				Moetz 2014
41	Hallan Çemi Tepesi	Building B	PPN, special building		9500±700	26.70				Moetz 2014
42	Ja'dat al-Mugharah	Maison des morts	PPN, special building	1.50	8200±600	7.29	2.67	2.73		Moetz 2014
43	Ja'dat al-Mugharah	Bâtiment communautaire	PPN, special building	1.50	8550±550	44.18			7.50	Moetz 2014
44	Jakovo-Kormadin	House 1	Neolithic in SEE, Sanctuary/temple/communal b,	4.50	4750±50	32.50	6.50	5.00		Jovanović 1991
45	Jebel Aruda	Grey Temple	Uruk, temple/special building	1.00	3175±175	187.00	15.60	12.00		v. Driel and v. Driel-Murray 2023
46	Jebel Aruda	Red Temple	Uruk, temple/special building	1.00	3175±175	156.00	13.00	12.00		v. Driel and v. Driel-Murray 2023
47	Jerf al-Ahmar	Bucranium building	PPN, special building		9100±200	9.60			3.50	Moetz 2014
48	Jerf al-Ahmar	EA 100	PPN, special building		9100±200	50.00			8.00	Moetz 2014
49	Jerf al-Ahmar	EA 30 (.00)	PPN, special building		9100±200	43.00			7.40	Moetz 2014
50	Jerf al-Ahmar	EA 53	PPN, special building		9100±200	50.00			8.00	Moetz 2014
51	Jerf al-Ahmar	EA 7 (.00)	PPN, special building		9100±200	38.50			7.00	Moetz 2014
52	Jericho	Tower of Jericho	PPN, special building	3.50	7800±500	65.00			9.00	Aurenche 2006
53	Khirbet esh-Shenef	Rectangular building XI	PN, special building	0.25	5550±50	37.00	>8.70	4.25		Akkermans and Wittmann 1993
54	Mishmar Ha'emeq	Flagstone structure	PPN, special building	2.00	7600±1600	104.00	13.00	8.00		Barzilai and Getzov 2008
55	Nemrik	Building 5	PPN, special building	0.25	8750±450	34.00	6.60	5.25		Moetz 2014
56	Nemrik	Building 4	PPN, special building	0.25	9500±300	33.00	7.00	6.00		Moetz 2014
57	Nevali Çori	Building 13	PPN, special building	0.36	8500±0	182.27	13.90	13.50		Moetz 2014
58	Qaramel	Grill house	PPN, special building	3.50	9400±1100	44.39	5.50	4.50	5.00	Moetz 2014
59	Qaramel	Tower	PPN, special building	3.50	9400±1100	44.18			7.50	Moetz 2014
60	Qermez Dere	RAA. RAB. RAD	PPN, special building	6.00	9000±0	24.00	6.00	4.00		Moetz 2014
61	Qermez Dere	RAE	PPN, special building	6.00	9400±600					Moetz 2014
62	Qermez Dere	RAF	PPN, special building	6.00	9400±600					Moetz 2014
63	Sabi Abyad I	Building I	PN, special building	5.00	5900±0	100.00	14.00	10.00		Akkermans and Le Miere 1992
64	Sabi Abyad I	Terasse	PN, terrasse	5.00	5900±0					Akkermans and Le Miere 1992
65	Sabi Abyad I	Building II (and oven area III)	PN, special building	5.00	6000±0	93.00	12.00	7.75		Akkermans and Le Miere 1992
66	Sabi Abyad I	Building V6	PN, special building	5.00	6055±175	70.00	10.00	7.00		Akkermans and Le Miere 1992
67	Tell Brak	Eye Temple	Uruk, temple/special building	300.00	3250±250	575.00	23.00	25.00		Oates <i>et al.</i> 2007
68	Tell Brak	Feasting hall	Uruk, temple/special building	300.00	3750±50	230.00	>23.00	10.00		Oates <i>et al.</i> 2007
69	Tell Hasna I	Lower temple	Early Dynastic I–II	1.75	2625±275					Munchaev <i>et al.</i> 2004
70	Tell Hasna I	Upper temple	Early Dynastic I–II	1.75	2625±275					Munchaev <i>et al.</i> 2004

Id	Site	Building	Category	Size (ha)	Dating	Floor (m ²)	L. (m)	W. (m)	Dia. (m)	Reference
71	Uruk	Building C	Uruk, temple/special building		3400±100	1188.00	54.00	22.00		Eichmann 2013
72	Uruk	Building E	Uruk, temple/special building		3400±100	3150.00	57.00	57.00		Eichmann 2013
73	Uruk	Limestone building	Uruk, temple/special building		3400±100	2280.00	76.00	30.00		Eichmann 2013
74	Uruk	Steinstiftgebäude	Uruk, temple/special building		3400±100	1185.00	53.33	22.20		Eichmann 2013
75	Uruk	White temple	Uruk, temple/special building		3450±0	385.00	22.00	17.50		Eichmann 2013
76	Uruk	Mittelsaalgebäude	Obaid, temple/special building		4125±125	280.00	19.00	14.70		Eichmann 2013
77	WF16	Structure O75	PPN, special building	0.10	9111±639	328.00			20.50	Finlayson 2024
78	Căscioarele-Ostrovel	Sanctuary 1	Neolithic in SEE, Sanctuary/temple/communal b,	0.50	4325±75	160.00	>16.00	10.00		Lazarovici and Lazarovici 2006, 534–543
79	Neo Nikomedia	Structure 4–1 (shrine)	Neolithic in SEE, Sanctuary/temple/communal b,	1.90	6150±100	160.00	13.60	11.80		Souvatzi 2008
80	Neo Nikomedia	Structure 4–2 (shrine)	Neolithic in SEE, Sanctuary/temple/communal b,	1.90	6150±100	99.00	10.90	9.10		Souvatzi 2008
81	Palioskala	Central building	Neolithic in SEE, Sanctuary/temple/communal b,	0.95	4500±0	75.00	9.00	8.25		Toufexis 2016
82	Sesklo (Late Neolithic)	Megaron (LN)	Neolithic in SEE, Sanctuary/temple/communal b,	0.35	4800±0	182.80	18.75	9.75		Theocharēs 1973
83	Vrbjanska Čuka	Building 1	Neolithic in SEE, Sanctuary/temple/communal b,	1.75	5850±150	144.00	12.00	12.00		Kitanovski <i>et al.</i> 1990; Naumov <i>et al.</i> 2021
84	Zorlentu Mare	L4	Neolithic in SEE, Sanctuary/temple/communal b,	3.00	5150±50					Link 2006
85	Berettyóújfalu-Herpály	House 11	Neolithic in SEE, Sanctuary/temple/communal b,	15.00	4600±23	67.5	11.75	5.75		Raczky <i>et al.</i> 2020
86	Parța I (East)	P20 (Casa Tribului)	Neolithic in SEE, Sanctuary/temple/communal b,	2.00	5050±150	50.0	10.00	5.00		Lazarovici and Lazarovici 2006, 300–337
87	Parța I (East)	Sanctuary 1	Neolithic in SEE, Sanctuary/temple/communal b,	2.00	5050±150	89.0	12.60	7.00		Lazarovici and Lazarovici 2006, 300–337
88	Parța I (East)	Sanctuary 2	Neolithic in SEE, Sanctuary/temple/communal b,	2.00	5050±150	69.6	11.60	6.00		Lazarovici and Lazarovici 2006, 300–337
89	Polgár-Csőszhalom	House 11	Neolithic in SEE, Sanctuary/temple/communal b,	24.00	4785±40	36.0	>9.00	4.00		Raczky and Sebők 2014
90	Uivar	H2b-11	Neolithic in SEE, Sanctuary/temple/communal b,	3.00	4750±50	51.5	10.30	5.00		Draseovan and Schier 2010
91	Vésztő Mágó	House 2 ('cult complex')	Neolithic in SEE, Sanctuary/temple/communal b,	3.90	5100±50	70.2	6.40	3.30		Hegedüs and Makkay 1990
92	Bodman-Ludwigshafen	'Tempel', 'Busenhaus'	'Cult building', lakeside settlement	0.50	3860±0	36.0	9.00	4.00		Schlichtherle 2016
93	Lake Chalain, site 19 (Jura, France)	Isolated structure	'Cult building', lakeside settlement	0.20	2986±18	47.5	9.50	5.00		Vielle 2002
94	Marin-Les Piéçettes NE	Marin-Les Piéçettes	'Cult building', lakeside settlement		3494±10	24.0	8.00	3.00		Honegger 2007
95	Sipplingen-Osthafen (B)	?	'Cult building', lakeside settlement	0.85	3840±0			4.00		Schlichtherle 2016
96	Adâncata	Ada-1	Trypillia mega-structure, high-level	1.50	4350±100	240.0	20.00	12.00		Hofmann <i>et al.</i> 2016
97	Baia	Bai-1	Trypillia mega-structure, high-level	1.95	4675±125	195.4	17.60	11.10		Hofmann <i>et al.</i> 2016
98	Bilyi Kamin	BK-1	Trypillia mega-structure, high-level	97.00	3850±50	381.0	36.00	10.00		Rud <i>et al.</i> 2019
99	Bilyi Kamin	BK-2	Trypillia mega-structure, high-level	97.00	3850±50	376.0	> 47.00	8.00		Rud <i>et al.</i> 2019
100	Bilyi Kamin	BK-3	Trypillia mega-structure, high-level	97.00	3850±50	733.0	64.00	11.50		Rud <i>et al.</i> 2019
101	Bilyi Kamin	BK-4	Trypillia mega-structure, low-level	97.00	3850±50	381.0	29.00	11.00		Rud <i>et al.</i> 2019
102	Chyzhivka	Chy-1	Trypillia mega-structure, high-level	20.00	4035±85	175.0	19.00	10.00		Hofmann and Shatilo in press-a
103	Dobrovody	Dob-1	Trypillia mega-structure, low-level	211.00	3770±50			14.90		Hofmann <i>et al.</i> 2019
104	Dobrovody	Dob-2	Trypillia mega-structure, low-level	211.00	3770±50	278.0	25.50	10.90		Hofmann <i>et al.</i> 2019
105	Dobrovody	Dob-3	Trypillia mega-structure, low-level	211.00	3770±50	586.3	33.50	17.50		Hofmann <i>et al.</i> 2019
106	Dobrovody	Dob-4	Trypillia mega-structure, low-level	211.00	3770±50	1209.0	46.50	26.00		Hofmann <i>et al.</i> 2019
107	Dobrovody	Dob-5	Trypillia, dwelling?	211.00	3770±50	212.0	21.20	10.00		Hofmann <i>et al.</i> 2019
108	Hlybochok	Hly-1	Trypillia mega-structure, high-level	130.00	3875±75	315.0	30.00	10.50		Ohlrau and Rud 2019

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109	Hlybochok	Hly-2	Trypillia mega-structure, high-level	130.00	3875±75	670.0	51.50	13.00		Ohlrau and Rud 2019
110	Hlybochok	Hly-3	Trypillia mega-structure, high-level	130.00	3875±75	178.5	21.00	8.50		Ohlrau and Rud 2019
111	Hlybochok	Hly-4	Trypillia mega-structure, low-level	130.00	3875±75	356.5	23.00	15.50		Ohlrau and Rud 2019
112	Kosenivka	House 2–4	Trypillia mega-structure, high-level	80.00	3650±50	232.0	29.00	8.00		Buzyan and Yakubenko 1990
113	Maidanetske	Mai 03	Trypillia mega-structure, low-level	200.00	3750±50	155.0	18.00	8.60		Hofmann <i>et al.</i> 2019
114	Maidanetske	Mai 01	Trypillia mega-structure, high-level	200.00	3800±170	312.0	>26.00	>12.00		Hofmann <i>et al.</i> 2019
115	Maidanetske	Mai 10	Trypillia mega-structure, low-level	200.00	3800±170	162.0	18.00	9.00		Hofmann <i>et al.</i> 2019
116	Maidanetske	Mai 11	Trypillia mega-structure, low-level	200.00	3800±170	158.0	17.0	9.3		Hofmann <i>et al.</i> 2019
117	Maidanetske	Mai 12	Trypillia mega-structure, low-level	200.00	3800±170	258.5	23.5	11.0		Hofmann <i>et al.</i> 2019
118	Maidanetske	Mai 13	Trypillia mega-structure, low-level	200.00	3800±170	122.5	17.5	7.0		Hofmann <i>et al.</i> 2019
119	Maidanetske	Mai 02	Trypillia mega-structure, low-level	200.00	3800±170	175.0	17.5	10.0		Hofmann <i>et al.</i> 2019
120	Maidanetske	Mai 04	Trypillia mega-structure, low-level	200.00	3800±170	180.0	18.0	10.0		Hofmann <i>et al.</i> 2019
121	Maidanetske	Mai 05	Trypillia mega-structure, low-level	200.00	3800±170	378.0	27.0	14.0		Hofmann <i>et al.</i> 2019
122	Maidanetske	Mai 06	Trypillia mega-structure, low-level	200.00	3800±170	578.0	34.0	17.0		Hofmann <i>et al.</i> 2019
123	Maidanetske	Mai 07	Trypillia mega-structure, low-level	200.00	3800±170	391.0	29.0	13.5		Hofmann <i>et al.</i> 2019
124	Maidanetske	Mai 08	Trypillia mega-structure, low-level	200.00	3800±170	334.0	23.0	14.5		Hofmann <i>et al.</i> 2019
125	Maidanetske	Mai 09	Trypillia mega-structure, low-level	200.00	3800±170	135.0	15.0	9.0		Hofmann <i>et al.</i> 2019
126	Moshuriv 1	Mos-1	Trypillia mega-structure, high-level	7.00	3785±155	238.7	31.0	7.7		Ohlrau and Rud 2019
127	Moshuriv 1	Mos-2	Trypillia mega-structure, low-level	7.00	3785±155	134.6	15.3	8.8		Ohlrau and Rud 2019
128	Moshuriv 1	Mos-3	Trypillia mega-structure, low-level	7.00	3785±155	149.2	16.4	9.1		Ohlrau and Rud 2019
129	Moshuriv 1	Mos-4	Trypillia mega-structure, low-level	7.00	3785±155	96.4	14.6	6.6		Ohlrau and Rud 2019
130	Nebelivka	Neb-1	Trypillia mega-structure, high-level	235.00	3860±90	1200.0	60.0	20.0		Gaydarska 2020
131	Nebelivka	Neb-10	Trypillia mega-structure, low-level	235.00	3860±90	376.0	23.5	16.0		Gaydarska 2020
132	Nebelivka	Neb-11	Trypillia mega-structure, low-level	235.00	3860±90	336.0	21.0	16.0		Gaydarska 2020
133	Nebelivka	Neb-12	Trypillia mega-structure, low-level	235.00	3860±90	387.5	25.0	15.5		Gaydarska 2020
134	Nebelivka	Neb-13	Trypillia mega-structure, low-level	235.00	3860±90	408.0	24.0	17.0		Gaydarska 2020
135	Nebelivka	Neb-14	Trypillia mega-structure, low-level	235.00	3860±90	345.0	23.0	15.0		Gaydarska 2020
136	Nebelivka	Neb-15	Trypillia mega-structure, low-level	235.00	3860±90	204.8	19.5	10.5		Gaydarska 2020
137	Nebelivka	Neb-16	Trypillia mega-structure, low-level	235.00	3860±90	268.8	21.5	12.5		Gaydarska 2020
138	Nebelivka	Neb-17	Trypillia mega-structure, low-level	235.00	3860±90	170.5	15.5	11.0		Gaydarska 2020
139	Nebelivka	Neb-18	Trypillia mega-structure, low-level	235.00	3860±90	340.0	34.0	10.0		Gaydarska 2020
140	Nebelivka	Neb-19	Trypillia mega-structure, low-level	235.00	3860±90	204.0	17.0	12.0		Gaydarska 2020
141	Nebelivka	Neb-2	Trypillia mega-structure, low-level	235.00	3860±90	375.0	25.0	15.0		Gaydarska 2020
142	Nebelivka	Neb-20	Trypillia mega-structure, low-level	235	3860±90	228.0	19.0	12.0		Gaydarska 2020
143	Nebelivka	Neb-3	Trypillia mega-structure, low-level	235	3860±90	551.3	31.5	17.5		Gaydarska 2020
144	Nebelivka	Neb-4	Trypillia mega-structure, low-level	235	3860±90		>10.0	16.5		Gaydarska 2020
145	Nebelivka	Neb-5	Trypillia mega-structure, low-level	235	3860±90	173.3	16.5	10.5		Gaydarska 2020

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146	Nebelivka	Neb-6	Trypillia mega-structure, low-level	235	3860±90	240.5	18.5	13.0		Gaydarska 2020
147	Nebelivka	Neb-7	Trypillia mega-structure, low-level	235	3860±90	433.5	25.5	17.0		Gaydarska 2020
148	Nebelivka	Neb-8	Trypillia mega-structure, low-level	235	3860±90	260.0	20.0	13.0		Gaydarska 2020
149	Nebelivka	Neb-9	Trypillia mega-structure, low-level	235	3860±90	527.3	28.5	18.5		Gaydarska 2020
150	Ozheve-Ostriv	House 3	Trypillia mega-structure, high-level		4350±100	200.0	20.0	10.0		Chernovol 2023
151	Petreni	Pet-1	Trypillia mega-structure, high-level	25	3855±35	368.0	32.0	11.5		Rassmann <i>et al.</i> 2014
152	Petreni	Pet-10	Trypillia mega-structure, low-level	25	3855±35	148.7	17.7	8.4		Rassmann <i>et al.</i> 2014
153	Petreni	Pet-11	Trypillia mega-structure, low-level	25	3855±35	184.8	21.0	8.8		Rassmann <i>et al.</i> 2014
154	Petreni	Pet-12	Trypillia mega-structure, low-level	25	3855±35	162.7	16.6	9.8		Rassmann <i>et al.</i> 2014
155	Petreni	Pet-13	Trypillia mega-structure, low-level	25	3855±35	137.3	15.6	8.8		Rassmann <i>et al.</i> 2014
156	Petreni	Pet-2	Trypillia mega-structure, low-level	25	3855±35	133.0	14.0	9.5		Rassmann <i>et al.</i> 2014
157	Petreni	Pet-3	Trypillia mega-structure, low-level	25	3855±35	131.3	15.5	8.5		Rassmann <i>et al.</i> 2014
158	Petreni	Pet-4	Trypillia mega-structure, low-level	25	3855±35	140.0	>12.5	11.2		Rassmann <i>et al.</i> 2014
159	Petreni	Pet-5	Trypillia mega-structure, low-level	25	3855±35	150.0	16.3	9.2		Rassmann <i>et al.</i> 2014
160	Petreni	Pet-6	Trypillia mega-structure, low-level	25	3855±35	182.3	13.5	13.5		Rassmann <i>et al.</i> 2014
161	Petreni	Pet-7	Trypillia mega-structure, low-level	25	3855±35	164.7	13.5	12.2		Rassmann <i>et al.</i> 2014
162	Petreni	Pet-8	Trypillia mega-structure, low-level	25	3855±35	201.0	20.2	10.0		Rassmann <i>et al.</i> 2014
163	Petreni	Pet-9	Trypillia mega-structure, low-level	25	3855±35	168.4	18.3	9.2		Rassmann <i>et al.</i> 2014
164	Stolniceni	Sto-1	Trypillia mega-structure, high-level	33	3825±125	254.0	28.5	9.0		Țerna <i>et al.</i> 2019
165	Stolniceni	Sto-2	Trypillia mega-structure, high-level	33	3825±125	185.5	23.0	8.8		Țerna <i>et al.</i> 2019
166	Talianky	Tal-1	Trypillia mega-structure, low-level	320	3738±87	144.0	18.0	8.0		Rassmann <i>et al.</i> 2014
167	Talianky	Tal-10	Trypillia mega-structure, low-level	320	3738±87	105.0	15.0	7.0		Rassmann <i>et al.</i> 2014
168	Talianky	Tal-2	Trypillia mega-structure, low-level	320	3738±87	161.0	22.0	7.2		Rassmann <i>et al.</i> 2014
169	Talianky	Tal-3	Trypillia, dwelling?	320	3738±87	176.0	25.0	8.0		Rassmann <i>et al.</i> 2014
170	Talianky	Tal-4	Trypillia mega-structure, low-level	320	3738±87	101.0	16.6	6.2		Rassmann <i>et al.</i> 2014
171	Talianky	Tal-5	Trypillia mega-structure, low-level	320	3738±87	93.0	15.2	6.0		Rassmann <i>et al.</i> 2014
172	Talianky	Tal-6	Trypillia mega-structure, low-level	320	3738±87	207.0	22.0	9.8		Rassmann <i>et al.</i> 2014
173	Talianky	Tal-7	Trypillia mega-structure, low-level	320	3738±87	195.0	22.0	8.8		Rassmann <i>et al.</i> 2014
174	Talianky	Tal-8	Trypillia mega-structure, low-level	320	3738±87	176.0	20.5	8.7		Rassmann <i>et al.</i> 2014
175	Talianky	Tal-9	Trypillia mega-structure, low-level	320	3738±87	118.0	15.0	7.7		Rassmann <i>et al.</i> 2014
176	Ternivka	Ter-1	Trypillia mega-structure, high-level	8	4065±15	317.3	33.4	9.5		Rud <i>et al.</i> in press
177	Trostianchyk	Tro-1	Trypillia, dwelling?	3	3965±5	175.0	23.0	7.6		Rud <i>et al.</i> 2018
178	Trostianchyk	Tro-2	Trypillia mega-structure, high-level	3	3965±5	195.0	22.4	8.7		Rud <i>et al.</i> 2018
179	Veselyi Kut	Ves-1	Trypillia mega-structure, high-level	60	4075±75	202.0	18.5	11.0		Hofmann and Shatilo in press-a
180	Veselyi Kut	Ves-2	Trypillia, dwelling?	60	4075±75	83.0	14.1	6.0		Hofmann and Shatilo in press-a
181	Veselyi Kut	Ves-3	Trypillia mega-structure, low-level	60	4075±75	105.0	17.9	6.0		Hofmann and Shatilo in press-a
182	Veselyi Kut	Ves-4	Trypillia mega-structure, low-level	60	4075±75	94.0	13.5	7.0		Hofmann and Shatilo in press-a
183	Veselyi Kut	Ves-5	Trypillia, dwelling?	60	4075±75	66.0	11.0	6.0		Hofmann and Shatilo in press-a

Id	Site	Building	Category	Size (ha)	Dating	Floor (m²)	L. (m)	W. (m)	Dia. (m)	Reference
184	Veselyi Kut	Ves-6	Trypillia mega-structure, low-level	60	4075±75	98.0	13.5	7.0		Hofmann and Shatilo in press-a
185	Viitivka	Vit-1	Trypillia mega-structure, high-level	48	3705±75	352.8	39.2	9.0		Ohlrau and Rud 2019
186	Viitivka	Vit-2	Trypillia mega-structure, high-level	48	3705±75	684.3	59.5	11.5		Ohlrau and Rud 2019
187	Viitivka	Vit-3	Trypillia mega-structure, high-level	48	3705±75	310.3	36.5	8.5		Ohlrau and Rud 2019
188	Vilshanka	Vil-1	Trypillia mega-structure, high-level	53	4135±55	389.0	37.4	10.4		Rud <i>et al.</i> in press
189	Volodymyrivka	Vol-1	Trypillia mega-structure, high-level	60	3865±65	443.0	>50.8	23.5		Hofmann and Shatilo in press-a
190	Volodymyrivka	Vol-10	Trypillia mega-structure, low-level	60	3865±65	220.8	18.4	12.0		Hofmann and Shatilo in press-a
191	Volodymyrivka	Vol-11	Trypillia mega-structure, low-level	60	3865±65	234.0	18.0	13.0		Hofmann and Shatilo in press-a
192	Volodymyrivka	Vol-2	Trypillia mega-structure, low-level	60	3865±65	532.0	28.0	19.0		Hofmann and Shatilo in press-a
193	Volodymyrivka	Vol-3	Trypillia mega-structure, low-level	60	3865±65	356.5	23.0	15.5		Hofmann and Shatilo in press-a
194	Volodymyrivka	Vol-4	Trypillia mega-structure, low-level	60	3865±65	387.5	25.0	15.5		Hofmann and Shatilo in press-a
195	Volodymyrivka	Vol-5	Trypillia mega-structure, low-level	60	3865±65	609.0	29.0	21.0		Hofmann and Shatilo in press-a
196	Volodymyrivka	Vol-6	Trypillia mega-structure, low-level	60	3865±65					Hofmann and Shatilo in press-a
197	Volodymyrivka	Vol-7	Trypillia mega-structure, low-level	60	3865±65	555.0	30.0	18.5		Hofmann and Shatilo in press-a
198	Volodymyrivka	Vol-8	Trypillia mega-structure, low-level	60	3865±65	187.0	>12.5	15.0		Hofmann and Shatilo in press-a
199	Volodymyrivka	Vol-9	Trypillia mega-structure, low-level	60	3865±65	353.6	26.0	13.6		Hofmann and Shatilo in press-a
200	Zabolotne	Zab-1	Trypillia mega-structure, high-level	37	4165±85	912.0	57.0	16.0		Rud <i>et al.</i> in press
201	Zabolotne	Zab-2	Trypillia mega-structure, high-level	37	4165±85	305.0	30.5	10.0		Rud <i>et al.</i> in press

Zu Gast bei Friedrich dem Großen, König von Preußen

Susanne Jahns, Kay-Uwe Uschmann

Dieser Beitrag ist Johannes Müller gewidmet, mit den allerbesten Wünschen für seinen 65. Geburtstag.

KEYWORDS: *Prussian court, sewer system, fruit growing, baroque tooth brush, royal table*

Zusammenfassung

Das Neue Palais in Potsdam-Sanssouci wurde durch König Friedrich II. von Preußen in den Jahren 1763–1769 erbaut. Er nutzte es für Feierlichkeiten und zur Unterbringung seiner Familie und von Gästen des königlichen Hofes.

In den Jahren 2014 bis 2018 wurde bei der archäologischen Begleitung von grundlegenden Sanierungsmaßnahmen des Sockelgeschosses ein System aus

geziegelten Abwasserkanälen aus der Bauphase des Neuen Palais freigelegt, die in der Zeit König Friedrichs II. genutzt wurden. Aus einem dieser Kanäle konnten Sedimentproben untersucht werden, die einiges an Hinterlassenschaften der luxuriösen Feiern von König Friedrich und seinen Gästen im Neuen Palais zu Tage brachten und einen kleinen Einblick in diese besondere Lebenswelt ermöglichen.

Abstract

The New Palace in Potsdam-Sanssouci was built by King Frederick II of Prussia in the years 1763–1769. He used it for celebrations and to accommodate his family and guests of the royal court.

In the years 2014 to 2018, a system of brick sewers from the construction phase of the New Palace, which were used during the time of King Frederick II, was

uncovered during the archaeological monitoring of fundamental renovation work on the basement floor. Sediment samples from one of these sewers were analysed, bringing to light some of the remains of the luxurious celebrations of King Frederick and his guests in the New Palace and providing a small insight into this special way of life.

DAS NEUE PALAIS IN POTSDAM

Am westlichen Ende des Parks Sanssouci in Potsdam liegt das Neue Palais (Abb. 1).

Dessen Bau wurde 1763 nach Beendigung des Siebenjährigen Krieges unter Friedrich II. begonnen und bereits 1769 fertig gestellt. Es gilt als die letzte bedeutende Schlossanlage des preußischen Barocks.

Die Bauleitung hatten zuerst die Architekten Johann Gottfried Büring und Heinrich Ludwig Manger, sie wurden aber bereits 1764 von Carl von Gontard

abgelöst. Friedrich II. nutzte das Schloss für Gäste seines Hofes, besaß allerdings auch eine kleine „Einliegerwohnung“ im südlichen Seitenflügel. Als Verbindungsweg zwischen Schloss Sanssouci und dem Neuen Palais diente die Große Allee, die heute den Hauptweg des Parks bildet. Vor der Errichtung des neuen Schlosses befanden sich an dessen Stelle die westlichen Ausläufer des Rehgartens — eines Eichenwaldes, der zum Jagdvergnügen genutzt wurde.



Abb. 1. Die Rückseite des neuen Palais vom Park Sanssouci gesehen (Foto: Susanne Jahns).

Leider sind die Archivunterlagen zum Bau des Neuen Palais oft ungenügend, wenn man Informationen zum eigentlichen Baugeschehen erhalten möchte. Lediglich die 1789 in der „Baugeschichte Potsdams“ von Heinrich Ludwig Manger überlieferten Hinweise lassen uns ein wenig in den Trubel dieser Großbaustelle hineinschauen (Manger 1789). Ludwig Mangers Leistung besteht vor allem darin, dass wir einen Überblick über die Bautätigkeiten des preußischen Königs erhalten, aber auch einen Eindruck von dessen ständiger Präsenz und dem Kampf um notwendige finanzielle Mittel, die er mit knappen Worten auf das jeweilige Jahr aufgegliedert darstellt. Entgegen dem ausdrücklichen Befehl von Friedrich II. hat Ludwig Manger die ihm zur Verfügung stehenden Bauakten nicht vernichtet, sondern archiviert — eine unschätzbare Quelle,

um die intensive Bautätigkeit im öffentlichen Raum durch den preußischen König zu erfassen.

Nach der Errichtung des Ensembles von Neuem Palais und Communs nutzte Friedrich II. dieses Objekt im Sommer für den Empfang hochgestellter Mitglieder deutscher und europäischer Herrscherhäuser (Kirschstein 2017). Losgelöst von dem strengen preußischen Hofzeremoniell, welches in Berlin und im Stadtschloss Potsdam uneingeschränkt galt und den Alltag bestimmte, konnten die königliche Familie und die engen Freunde und Bekannten des Herrschers das entspannte Sommerleben mit Festen, Hochzeiten, Feuerwerken und Theateraufführungen genießen. Nach dem Tode von Friedrich II. im Jahr 1786 wurden die Aktivitäten im Neuen Palais deutlich reduziert.

DIE ARCHÄOLOGISCHEN UNTERSUCHUNGEN UND DIE ENTDECKUNG DER ZIEGELKANÄLE

Von 2013 bis 2018 fand im Rahmen von Sanierungsmaßnahmen im und am Neuen Palais eine archäologische Baubegleitung durch die Firma archaeofakt Döhner + Uschmann GbR statt, da dabei eine Teilerstörung des eingetragenen Bodendenkmals 2167 — Fundplatz der Urgeschichte — stattfand. Die ersten Beobachtungen zu diesem Fundplatz stammen noch

aus der Zeit des Neubaus des Neuen Palais. Dieser ist somit einer der ersten bekannten archäologischen Fundplätze in Brandenburg. Damals geborgene Gefäße, wohl Urnen und Beigefäße eines eisenzeitlichen Gräberfeldes wurden in die königliche Sammlung eingegliedert.

Die baubegleitende Kontrolle, bei der explizit für die Archäologie keine zusätzlichen Erdeingriffe angelegt werden sollten, um eine weitere Zerstörung der historisch gewachsenen Schichtenabfolgen zu vermeiden, erbrachte zahlreiche interessante Baubefunde und Besonderheiten, die noch der wissenschaftlichen Auswertung harren. Nachfolgend soll davon nur ein System von gezielten Wasserabläufen (Befund 2) vorgestellt werden, die in unmittelbarer Nähe des Sockelgeschosses erfasst wurden.

Bereits beim ersten dieser als Ziegelkanal bezeichneten Befunde am Mittelrisalit der Gartenseite war das Interesse geweckt, da die Bauausführung und der Erhaltungszustand beeindruckten. Innenmessungen ergaben oft eine erhaltene Länge von 4–6 m. Auch waren manche dieser Objekte eingestürzt, verfüllt oder es gab Richtungsänderungen.

Wann hatte man diese Leitungen angelegt und wozu dienten diese? Fragen, die sich nun auch in den Fokus unserer nachfolgenden baubegleitenden Betreuung schoben.

Die von uns beobachteten Anlagen variierten in Aufbau und Abflussbreite. Generell aus Ziegeln im Kalk-Sand-Mörtelverband erbaut, wobei die verwendeten Ziegelsteine eine gute bis sehr gute Qualität besaßen, war die Abflussfläche schwarz abgehoben. Dies konnte bedeuten, dass hier ehemals Schmutzwasser, mit organischen Resten durchsetzt, abgeflossen war. Ein leichtes Gefälle weg vom Baukörper war zu konstatieren. Bei der Nordseite des Neuen Palais wurden dann erneut Reste eines — hier allerdings zerstörten Kanals — erfasst und dokumentiert. Bei der Betreuung der zahlreichen Erdeingriffe im Areal des Eishofes zwischen Hofdamenflügel und Prinz-Heinrich-Flügel wurden weitere vergleichbare Objekte erfasst, sodass zwei Typen dieser Bauten unterschieden werden konnten:

Neben den spitzen Überdeckungen, bei der jeweils ein Ziegel schräg gegen den anderen gelehnt war, kamen auch gewölbte vor. Beide Formen waren innen etwa 0,30 bis 0,35 m breit und 0,40 bis 0,44 m hoch. Die verwendeten Ziegel besaßen eine gute Beschaffenheit und waren stets hart gebrannt. Auch der Mörtel gehörte zur qualitativ hochwertigen Sorte. Das bei den Ziegeln vorherrschende Format (Länge x Breite x Höhe = 27 x 13 x 8 cm) wurden bei allen Objekten gefunden. Nur selten war aber die Nutzung von bearbeiteten Ziegelsteinen zu erfassen — meist war die Grundform erhalten und Varianten in der Bauform (Spitzdeckung, Kraggewölbe *etc.*) durch die Menge des verwendeten Kalkmörtels erzeugt.

Während im Eishof auf der Abflussebene der gewölbten Abwasserleitung keine älteren Auflagerungen festgestellt werden konnten, war in der Südostecke am Übergang vom Hofdamenflügel zum Heinrichsflügel

der spitzgieblige Abschnitt der Leitung nahe dem Übergang zum alten kupfernen Fallrohr fast komplett zugesetzt. Um einen ersten Eindruck von den hier betroffenen Verfüllungen zu gewinnen, wurden diese vor Ort detailliert untersucht. Zahlreiche Blätter von Laubbäumen zeigten, dass hier neben Schmutzwasser wahrscheinlich auch Regenwasser vom Dach gesammelt abgeleitet worden war. In den unteren Schichten waren dann auch Gegenstände des Alltages der Schlossbewohner:innen eingelagert. Wahrscheinlich stammten die Verfüllungen hauptsächlich aus der 2. Hälfte des 19. Jahrhunderts, als man diesen Bereich des Schlosses als Hofdamenflügel nutzte. Als Sonderfund wurde hier ein komplett erhaltener Siegelabdruck geborgen, der einem Clanchef aus dem schottischen Hochlandclan der MacKay zugeschrieben werden konnte. Obwohl nur 1 cm groß, waren alle signifikanten Zeichen im und am abgebildeten Wappenschild bis hin zum Motto des MacKay-Clans „*Manu forti*“ (mit starker Hand) erkennbar. Dieses seltene Objekt belegt die rege Korrespondenzfähigkeit am Preußischen Hof im 18./19. Jahrhundert.

Im Ehrenhof konnten wir im Rahmen der Dokumentation des Profils 58 feststellen, dass der hier in der Grabensohle vorhandene Ziegelkanal aus der Bauzeit stammt, da alle wichtigen Auffüll- und Wegeschichten über dem Objekt angeordnet waren. Deutlich war der Unterschied zu einer späteren Baumaßnahme erkennbar, die sich südlich im Profil anschloss und bei der ein geordneter Schichtenaufbau der allmählich gewachsenen Verfüllung aus der Entstehungszeit fehlte.

Die aufgefundenen Kanäle sind mit Hilfe des Christian Friedrich Gottlieb Schadow zugeschriebenen Bauplans von 1796 zu verorten (Drescher 1991, 80 Abb. 71), wobei wir davon ausgehen, dass der exakte Verlauf der jeweiligen Abflussleitungen dem Planersteller nicht immer bekannt war, wie einige Differenzen zwischen den Verlaufsvorgaben im Plan und der realen Lage der Kanäle an der Gartenfront vermuten lassen. Trotzdem haben wir mit diesem Plan den direkten Beweis dafür, dass eine geplante Abwasserführung weg vom Neuen Palais bereits in der Bauphase angelegt und ausgeführt worden war. Wohin diese Kanäle und damit die Abwässer dann geführt wurden — vielleicht in den umgebenden Graben, Sickergruben oder Bachläufe — konnte im Rahmen dieser Maßnahme nicht geklärt werden, da wir nur die unmittelbare Umgebung des Neuen Palais bearbeiten konnten.

Für die Stadt Potsdam gab es zu dieser Zeit bereits Jauchegruben und Sammelbehälter, die für eine Bezahlung auch entleert wurden. Allerdings versuchten die Bewohner:innen dieses Geld zu sparen und entsorgten ihre Abfälle in Gräben, Bächen und Kanälen, sodass erhebliche Geruchsbelästigungen und Rattenbefall auftraten. Die Jauchegräben nutzte man häufig

auch als Grenzlinie zwischen den einzelnen Grundstücken. Damit war eine Zuweisung schwierig und es entstanden oft Streit und Nachbarschaftsreibeien. Friedrich II. setzte deshalb hohe Strafen aus, wenn man sich bei illegaler Entsorgung erwischen ließ, ohne jemals das Problem zu lösen (Potsdamer Abwassergeschichte 2003, 7–8). Unter diesem Eindruck ist natürlich verständlich, dass der königliche Bauherr beim Neubau des Schlosses auf ein funktionables Abwassersystem Wert legte, zumal im Schloss Sanssouci nichts dergleichen vorhanden war und die Entsorgung der Fäkalien in die Lärchenbestände auf der Terrasse des Schlosses ein gewisses olfaktorisches Problem mit sich brachte (Huth 1929, 19).

Ein Ziegelkanalrest im nördlichen Anschluss der Haupttreppe im Ehrenhof (Abb. 2), der anhand der Schichtenüberdeckung nachweisbar in die Bauausführung aus den Jahren 1764/65 datiert, wies, durch einen glücklichen Umstand herbeigeführt, eine mächtige Verfüllschicht auf, die aus der barocken Nutzungsphase des Schlosses stammt. Der Überrest eines alten Filzpantoffels hatte als „Falle“ für die Anschwemmungen gedient. Papierreste, die wir direkt bei der Bergung fanden, zerfielen leider sofort nach dem Kontakt mit Sauerstoff.

Gleichzeitig zeigten einige Kleinfunde aus dem Alltag der Schlossbewohner:innen (z. B. Pfeifenstiele, Korken und Keramikscherben), dass man auch Waschwasser und anderes Brauchwasser auf diesem Wege entsorgte, wie wir bereits durch die Funde bei einigen Ziegelkanälen aus dem Bereich des Eishofes vermuteten. Zum Glück hatte man diesen Ziegelkanal im 20. Jahrhundert nicht mehr genutzt, denn er wurde im Rahmen der wilhelminischen Neuverlegungen der Schmutzwasserleitung ab 1888 vom System getrennt



Abb. 2. Ziegelkanalstück am Mittelrisalit Ehrenhofseite vor der Bergung der Sedimentprobe (Foto: Kay-Uwe Uschmann).

und durch ein glasiertes Tonrohr ersetzt, sodass wir hier so etwas wie eine Zeitkapsel vorfanden, die entschlüsselt werden sollte.

DIE BOTANISCHEN UNTERSUCHUNGEN AN DER VERFÜLLSCHICHT DES ZIEGELKANALS IM EHRENHOF

Eine kleine Probe wurde zur pollenanalytischen Untersuchung aufbereitet. Diese ergab ein Pollenspektrum, dass den Waldbewuchs der näheren Umgebung (z. B. den angrenzenden Rehgarten) als Kiefern-Eichen-Birkenwald mit einem gewissen Anteil von Buche darstellt (Tabelle 1). Die Birke ist als Hängebirke (*Betula pendula*) fernerhin durch Funde von Früchtchen und Knospenschuppen nachgewiesen (Tabelle 2). „Exotische“ Bäume des Parks Sanssouci spiegeln sich nicht wider. Als gepflanzter Baum ist lediglich die Walnuss belegt, ihre Werte liegen aber auf sehr niedrigem Niveau. Walnusspollen ist in anderen neuzeitlichen Ablagerungen aus Brandenburg wesentlich zahlreicher vorhanden (Jahns 2023). Der Bewuchs der Niederungsgebiete wird durch Erlenpollen dargestellt. Ein größerer Anteil von Roggenpollen weist auf landwirtschaftlich genutzte

Flächen in der Nähe. Hohe Werte von Wildgraspollen zeigen viel offenes Land.

Zwei Liter der Verfüllschicht wurden mit einer Maschenweite von 37,5 µm geschlämmt. Dabei fanden sich u. a. Eierschalen, dünnwandige farbige Glasscherben (Tafel 1), Papierfetzen, viele Insektenreste und kleine Knochen. Letztere wurden dankenswerter Weise von Peggy Morgenstern bestimmt und erbrachten die sieben Tierarten Hausschwein, Schaf/Ziege, Haushuhn, Rebhuhn, Hausente, Dorsch und Feldmaus. Mit der Ausnahme der Mäuseknochen handelt es sich sicherlich um Speiseabfälle.

Den Hauptteil der Funde stellen aber zahlreiche Pflanzenreste (Tabelle 2, Tafel 1). Dabei handelt es sich überwiegend um Obst. Die Gärten von Sanssouci waren zur Zeit Friedrichs II. für seine Obstpflanzungen

Tabelle 1. Ergebnisse der pollenanalytischen Untersuchungen, Werte sind als Prozente der Gesamtsumme der terrestrischen Taxa (TTP) angegeben.

		Werte % TTP
Kiefer	<i>Pinus</i>	43,5
Birke	<i>Betula</i>	8,8
Eiche	<i>Quercus</i>	8,8
Erle	<i>Alnus</i>	4,6
Buche	<i>Fagus</i>	3,2
Hasel	<i>Corylus</i>	1,0
Ulme	<i>Ulmus</i>	0,9
Hainbuche	<i>Carpinus</i>	0,7
Linde	<i>Tilia</i>	0,6
Esche	<i>Fraxinus</i>	0,3
Walnuss	<i>Juglans</i>	0,1
Roggen	<i>Secale</i>	6,9
Wildgräser	Poaceae	9,5
Spitzwegerich	<i>Plantago lanceolata</i>	2,6
Sauerampfer	<i>Rumex acetosa</i> -Typ	1,6
Beifuß	<i>Artemisia</i>	0,9
Kreuzblüter	Brassicaceae	0,4

berühmt, denn der König förderte den Anbau von Obst, sowohl einheimischen als auch exotischen Ursprungs, sehr (Schurig 2012). Vieles darüber kann man in der von Marina Heilmeyer herausgegebenen Reihe der Potsdamer Pomologischen Geschichten erfahren. Mit Resten von Kirsche, Pfirsich, Wein und Feige sind von den vielen, urkundlich überlieferten Obstarten, einige der nach Marina Heilmeyer (2008a) vom König bevorzugtesten Früchte im botanischen Fundgut enthalten. Die Geschichte dieser vier Obstarten fing auf dem Gebiet Berlin-Brandenburg im Mittelalter an. Begonnen hatten den Obstbau dort nach heutigem Kenntnisstand die frühmittelalterlichen slawischen Siedler:innen. Aus ihrer Zeit sind an verschiedenen Orten Pflaumen, Birnen, Weinreben, Quitten sowie Sauerkirschen und Walnüsse belegt (Jahns *et al.* 2018). Für die letzten beiden wird eine Herkunft aus dem byzantinischen Reich vermutet, von wo aus sie von den slawischen Stämmen bei ihrer Wanderung nach Westen mitgebracht wurden. Pfirsiche und Süßkirschen sind erst für das Hohe Mittelalter belegt (Lange 1988; Wiethold 2004; Stika 2022). Der Weinbau erlebte in dieser für ihn klimatisch günstigen Periode eine Blütezeit (botanische Belege dazu siehe Jahns 2015; 2023). Auch Feigenkerne aus dem Hohen Mittelalter wurden mehrfach entdeckt (Jahns *et al.* 2018). Von diesen ist aber wohl kein Anbau von Feigenbäumen abzuleiten, sondern eher ein Fernhandel mit Trockenfrüchten. Der Anbau von Feigen in Berlin ist für das 17. Jh. schriftlich dokumentiert und in Potsdam für das frühe 18. Jh. (Heilmeyer 2013).

Die Vorliebe des Königs Friedrichs II. für Kulturobst steht also in einer gewissen Tradition, denn auch im Mittelalter ist davon auszugehen, dass diese Früchte zu meist den begüterten Schichten vorbehalten waren. Für seinen Obstbau war der König allerdings nicht auf das bereits in Berlin und Brandenburg heimisch gewordene Kulturobst — heute würde man von alten Sorten sprechen — angewiesen. Er kaufte seine Obstpflanzen für große Summen von weither ein, auch solche, die außerhalb von Glashäusern nicht überwintern konnten, wie z. B. Orangen, Bananen und Ananas (Schurig 2012).

Zum einen für diese empfindlichen Pflanzen, zum anderen, weil er frisches Obst auch außerhalb der Saison verfügbar haben wollte, ließ Friedrich II. mit großem finanziellen, energetischen und personellen Aufwand Treibmauern und beheizbare Gewächshäuser bauen und unterhalten, die zu einer Verfügbarkeit der Früchte weit über die übliche Erntezeit hinaus verhalfen (Schurig 2012). Ermöglicht wurde dieser Luxus u. a. durch eine äußerst geringe Entlohnung der Gärtner (Heilmeyer 2008a).

Bezüglich der aus dem Mischwasserkanal geborgenen Obstreste sind in vielen Fällen auch die Standorte der Pflanzungen überliefert. Feigen und Weinreben wachsen noch heutzutage auf den Weinberg-Terrassen von Sanssouci, die einen Eindruck der barocken Anlagen vermitteln.

Den zahlenmäßig größten Anteil der Pflanzenreste stellen Nüsschen von Erdbeeren. Leider ist es nicht möglich, diejenigen der kultivierten Erdbeeren von denen der einheimischen Wildformen, der Wald-Erdbeere (*Fragaria vesca*), der Moschus-Erdbeere (*Fragaria moschata*) und der Knack-Erdbeere (*Fragaria viridis*) zu unterscheiden, da sie in der Größe sehr variabel sind. Dennoch ist es bei dieser Menge und im Kontext mit eindeutigen Gartenfrüchten sehr wahrscheinlich, dass sie ebenfalls aus dem Garten stammen, zumal die Wildformen seit dem Mittelalter auch kultiviert wurden (Heilmeyer 2008b). Besonders die Moschus-Erdbeere, die nachweislich spätestens seit dem frühen 17. Jh. in Gärten wuchs, war lange Zeit die am häufigsten angebaute Erdbeere in Europa. Bei der heutigen Garten-Erdbeere (*Fragaria x ananassa*) handelt es sich um eine in der Mitte des 18. Jh. in Holland entstandene Kreuzung aus den beiden amerikanischen Erdbeerarten Chile-Erdbeere (*Fragaria chiloensis*) und Scharlach-Erdbeere (*Fragaria virginiana*). Zeitlich wären also sowohl diese überseeischen Erdbeeren, als auch ihre Hybridform für das Neue Palais bereits möglich. Nach Marina Heilmeyer (2008b) kam es während der Regierungszeit Friedrichs II. von Preußen zu einer Intensivierung des Erdbeer-Anbaus, der in einem Werk des Hofgärtners Friedrich Zacharias Salzmann im Jahr 1783 beschrieben wird.

Tabelle 2. Ergebnisse der archäobotanischen Untersuchungen. Werte sind als Stückzahl angegeben.

Deutscher Name	Rest-Typ	Summe	Wissenschaftlicher Name
Gewürz			
Kümmel	Sa/Fr	210	<i>Carum carvi</i>
Gemüse			
Gurke	Sa/Fr	2	<i>Cucumis sativa</i>
Nüsse			
Walnuss	Schale	1	<i>Juglans regia</i>
Obst			
Erdbeere	Sa/Fr	8738	<i>Fragaria</i> sp.
Himbeere	Sa/Fr	868	<i>Rubus idaeus</i>
Brombeere	Sa/Fr	121	<i>Rubus fruticosus</i>
Rubus-Arten	Sa/Fr	10	<i>Rubus</i> sp.
Weinrebe	Sa/Fr	97	<i>Vitis vinifera</i>
Feige	Sa/Fr	41	<i>Ficus carica</i>
Süßkirsche	Sa/Fr	13	<i>Prunus avium</i>
Schwarzer Holunder	Sa/Fr	8	<i>Sambucus nigra</i>
Heidelbeere	Sa/Fr	6	<i>Vaccinium myrtillus</i>
Pfirsich	Sa/Fr	1	<i>Prunus persicaria</i>
Bäume			
Hängebirke	Sa/Fr	321	<i>Betula pendula</i>
Hängebirke	Fruchtschuppen	9	<i>Betula pendula</i>
Wildkräuter			
Vogelmiere	Sa/Fr	88	<i>Stellaria media</i>
Schwarzer Nachtschatten	Sa/Fr	11	<i>Solanum nigrum</i>
Kornblume	Sa/Fr	6	<i>Centaurea cyanus</i>
Große Brennnessel	Sa/Fr	5	<i>Urtica dioica</i>
Klettenkerbel	Sa/Fr	3	<i>Torilis</i> sp.
Simse/Braunes Zypergras	Sa/Fr	3	<i>Scirpus/Cyperus fuscus</i>
Wiesen-Löwenzahn	Sa/Fr	3	<i>Taraxacum officinalis</i>
Winden-Knöterich	Sa/Fr	3	<i>Polygonum convolvulus</i>
Ampfer-Knöterich	Sa/Fr	2	<i>Polygonum lapathifolium</i>
Herbst-Milchkraut	Sa/Fr	2	<i>Leontodon autumnalis</i>
Vogel-Knöterich	Sa/Fr	2	<i>Polygonum aviculare</i>
Weißer Gänsefuß	Sa/Fr	2	<i>Chenopodium album</i>
Binse	Sa/Fr	1	<i>Juncus</i> sp.
Gewöhnlicher Feldsalat	Sa/Fr	1	<i>Valerianella locusta</i>
Klatschmohn	Sa/Fr	1	<i>Papaver rhoeas</i>
Melde	Sa/Fr	1	<i>Atriplex</i> sp.
Taubnessel	Sa/Fr	1	<i>Lamium</i> sp.
Tollkirsche	Sa/Fr	1	<i>Atropa bella-donna</i>
Vielsamiger Gänsefuß	Sa/Fr	1	<i>Chenopodium polyspermum</i>
Korbblüter	Sa/Fr	1	Asteraceae p. p.

Die sehr zahlreichen Kerne von Brombeeren und Himbeeren sowie wenige Nachweise von Heidelbeeren und Schwarzem Holunder stammen hingegen nicht von Kulturpflanzen. Die Kulturformen dieser Beerensträucher wurden erst im 19. und 20. Jh. aus Amerika eingeführt. (Keipert 1981). Es scheint fraglich, ob

die Wildformen dieser Sträucher im Garten gepflanzt wurden. Hierbei handelt es sich wahrscheinlicher um gesammeltes Obst.

Aus den ebenfalls schriftlich überlieferten Küchen- gärten stammen die Nachweise eines Gewürzes (Kümmel) und eines Gemüses (Gurke). Letztere stammt

ursprünglich aus Indien (Körber-Grohne 1995) und wurde von den Slawen nach Osteuropa eingeführt. Dort gibt es zahlreiche Nachweise der Gurke ab dem frühen Mittelalter (Opravil 1979). Im hohen Mittelalter fand sie ihren Weg in das heutige Ost- und Mitteledeutschland. Wahrscheinlich war sie dort — wie viele der Obstsorten — lange Zeit eine der Oberschicht vorbehaltenen Rarität, denn die wenigen hochmittelalterlichen Funde stammen ausschließlich aus städtischem und klösterlichem Kontext (Lange, 1987; 1994). Von 1586 liegen Zeichnungen der Gurke aus dem „Kreutterbuch deß Hochgelehrten und weltberühmten Herrn Dr. Petri Andreae Mattiolo“ von Joachim Camerarius vor (zitiert nach Körber-Grohne 1995, 305). Stadtkerngrabungen in

Norddeutschland erbrachten auch einzelne botanische Funde aus der frühen Neuzeit (z. B. Wiethold 2003). Aus Brandenburg gibt es solche Nachweise bisher nicht, sodass über ihre Verbreitung zur Zeit Friedrich II. nichts bekannt ist. 100 Jahre später, am Ende des 19. Jh., schildert Theodor Fontane in seinen „Wanderungen durch die Mark Brandenburg“ die Gurke als bedeutendes landwirtschaftliches Produkt im Brandenburger Spreewald (Fontane 1882 in der Ausgabe von 1989, 9).

In der Verfüllung des Kanals fanden sich neben den Resten der Kulturpflanzen, auch Samen von Wildkräutern von überwiegend frischen, nährstoffreichen Wuchsorten, neben Ruderalpflanzen auch solche aus Unkrautfluren sowie Wiesenpflanzen (Tabelle 2).

ÜBERLEGUNGEN ZU DEN BOTANISCHEN FUNDEN

Warum finden wir in der Verfüllschicht des Ziegelkanals so überwiegend Obstreste?

Vieles spricht dafür, dass es sich in erster Linie um die Überreste von — vornehm ausgedrückt — verzehrten Speisen handelt, die dem Verdauungsvorgang standgehalten haben. Bei den meisten Obstresten handelt es sich um Diasporen, die vor dem Verzehr nicht aus dem Obst entfernt werden (Erdbeeren, Himbeeren, Brombeeren, Feigen, Weinbeeren, Holunderbeeren, Heidelbeeren). Das gleiche trifft auf die Gurke zu, die als einziges Gemüse belegt ist. Bei vielen Gemüsen (Wurzelgemüse, Blattgemüse) gelangen die Samen allerdings gar nicht erst ins Essen.

Es gibt reichlich Literatur, welche die Einrichtung des Neuen Palais in der Zeit Friedrichs II. bis in Detail beschreibt. Wie aber bei den Toilettengängen verfahren wurde, ist zwar für das Schloss Sanssouci bekannt (Nachtöpfe), jedoch nicht für das Neue Palais. Toiletten und Bäder mit fließend Wasser gab es aber auch dort noch nicht. Solche sanitären Einrichtungen ließ erst Kronprinz Friedrich Wilhelm (später Kaiser Friedrich III.) ab den 1860er Jahren einbauen (Kirschstein 2017). So gehen wir hier, trotz der Abwasserkanäle, ebenfalls von einem Nachttopf-System aus. Allerdings ist uns ebenso wie das Ende der Kanäle auch ihr Anfang nicht bekannt. Bei der archäologischen Betreuung wurden Fallrohre aus Kupferblech als Verbindung zu den einzelnen Ziegelkanälen beobachtet, die als Transportweg im Gebäude angesehen werden sollten. Wir können nicht mit Sicherheit sagen, an welcher Stelle das vorher verzehrte Obst dort hineingelangt ist. Aber angesichts derjenigen Teile des Obstes, die vor dem Essen aus der Frucht entfernt werden, wie Kirsch- und Pfirsichsteine, die Walnusschalen und ebenso manche der Kleinfunde, wie zum Beispiel die Glasscherben und die Eierschalen (Tafel 1), ist sicher davon auszugehen, dass nicht nur die Inhalte der Nachtöpfe in den Kanal entsorgt

wurden, sondern dieser auch anderweitig zur Abfallbeseitigung genutzt wurde, z. B. für die Abfälle der in den Communs gelegenen Küchen (Kirschstein 2017).

Anderswo war man zu dieser Zeit schon weiter. Aus dem Schloss Bothmer im mecklenburgischen Klützer Winkel gelegen, ist uns eine noch heute vorhandene Toilettenanlage bekannt, die als Plumpsklo aus einer marmornen Schüssel mit einfacher Wasserspülung und Geruchsabschluss konzipiert war. Dieses nach 1726 errichtete Gebäude besaß eine Möglichkeit für ein Reinigen des Toilettenschachtbodens mit fließendem Wasser, welches dann in den Burggraben geleitet wurde.

Von Friedrich II. ist überliefert, dass er Obst, überwiegend frisches Obst, in hohem Maße zu schätzen wusste und in seinen Gemächern Schüsseln und Teller mit Obst verteilt standen, von dem er sich zu bedienen pflegte (Diebitsch 1802, zitiert nach Koch 2012).

Essen spielte für den König überhaupt eine wichtige Rolle. Viele Informationen zur Esskultur an seinem Hof bietet die Aufarbeitung von Menuezetteln und Hofrechnungen durch Bernd Maether (2008), die auch in „Das Preussische Kochbuch: Köstlichkeiten und Geschichten aus der königlichen Küche“ eingeflossen ist (Maether und Pietzner 2024). In dessen Kochrezepten finden auch einige unserer Pflanzenfunde Erwähnung. Für die Zeit Friedrichs II. sind das Kümmel, Gurke, Wein, Süßkirsche und Pfirsich. Auch die wenigen Knochenfunde finden sich dort in den Fleisch- und Fischgerichten dieser Zeit wieder — mit Ausnahme des von uns belegten Hausschweins. In den 1750er Jahren wurden bei den Abendessen mit seinen Gästen oftmals 16 verschiedene Gerichte, gern fettig und stark gewürzt, serviert, was den großen Anteil der Kümmelsamen im Fundgut erklären könnte. Zum Nachtschisch wurde ebenfalls Obst — frisch, getrocknet oder einge-
macht — gereicht, sowie Konfekt (Koch 2012).



Abb. 3. Ein Anreiz für gute Zahnpflege? Flötenkonzert Friedrichs des Großen in Sanssouci, Gemälde von Adolph Menzel. Nationalgalerie Staatliche Museen zu Berlin (bpk/Nationalgalerie, SMB/Jörg P. Anders).

Abends gab Friedrich II. auch gerne Flötenkonzerte, für die er noch heute bekannt ist, u.a. durch das Gemälde von Adolf von Menzel, das heute in der Alten Nationalgalerie in Berlin betrachtet werden kann (Abb. 3).

Frisches Obst, wie Friedrich II. es so sehr liebte, ist gesund. Ob aber die Zubereitung, in der die Früchte bei der königlichen Tafel serviert wurden, dies immer erfüllt hat, ist fraglich. Das liegt an einem Zusatz, der häufig dem Nachtisch beigegeben wird — dem Zucker. Dieser vollzog zur fraglichen Zeit gerade seine Metamorphose vom Luxusprodukt zum Grundnahrungsmittel — wenn man nicht korrekterweise von einem kalorienhaltigen Suchtstoff sprechen sollte. Die Geschichte des Massenprodukts Rohrzucker ist für Europa im höchsten Maße unrühmlich und mit unendlichem Leid verbunden. Er wird aus dem Saft des Grases Zuckerrohr (*Saccharum officinarum*) gewonnen. Ursprünglich in Polynesien beheimatet, gelangte es bereits als Nutzpflanze erst nach Indien und China und im Mittelalter mit der arabischen Westexpansion nach Südeuropa (Hobhouse 2005). Dort wurde das Zuckerrohr auch angebaut und Zucker ist seit dieser Zeit in ganz Europa bekannt. Er war aber den reichen

Bevölkerungsschichten vorbehalten und wurde vor allem als Gewürz und Medizin angewendet (Mintz 2007). Ab Ende des 15. Jahrhunderts gelangte er über die Azoren und die Kanarischen Inseln in die Karibik, von wo aus seine unheilvolle Karriere zu einem der wichtigsten Handelsgüter jener Zeit startete. Diese ist untrennbar mit Kolonialismus und dem transatlantischen Sklavenhandel verknüpft und hat die Ökonomie und Gesellschaft Europas im 17./18. Jh. nachhaltig beeinflusst (Hobhouse 2005; Mintz 2007). Zur Zeit Friedrichs II. war der Rohrzucker marktbeherrschend, auch wenn der Rübenzucker, welcher aus der Zuckerrübe (*Beta vulgaris* subsp. *altissima*) gewonnen werden kann, 1747 durch Andreas Sigismund bereits entdeckt und dies dem preußischen König zur Kenntnis gebracht worden war. Dieser Zucker erlangte aber erst durch die napoleonische Kontinentalsperre 1806–1813 seinen Durchbruch. Am Hofe König Friedrichs II. wird also Rohrzucker verwendet worden sein.

Zucker gilt aufgrund seines Kaloriengehalts heutzutage als Grundnahrungsmittel und generell als Genussmittel. In größeren Mengen konsumiert ist er aber höchst ungesund und fördert u.a. Diabetes, Adipositas und Karies. Zumindest die beiden letztgenannten

unerwünschten Folgen des Genusses von Zucker waren in der frühen Neuzeit durchaus bekannt (Mintz 2007). Auch wenn Friedrich II. sein Obst gerne frisch verzehrte, kamen die Früchte auch in Form von zuckerhaltigen Desserts und Konfekt auf seinen Tisch.

Zeitgenössische zuckerhaltige Rezepte sind zahlreich überliefert (u. a. Maether 2008; Schäfer 2017). Für die Herstellung von Eis aus gezuckerten Fruchtzubereitungen wurde 1775 extra ein Konditor aus Italien angestellt (Klenner 2024).

ZU DEN FOLGEN DES ZUCKERKONSUMS – DIE ZAHNBÜRSTE

Dies leitet über zu einem besonderen Fund, der hier passend zu den Pflanzenresten vorgestellt werden soll: aus dem vielfältigen archäologischen Fundspektrum der Ausgrabung soll hier ein Einzelfund Erwähnung finden, der eine absolute Ausnahmestellung einnimmt – eine knöcherne Zahnbürste, die im Sockelgeschoss direkt unter dem Wohnbereich des Königs Friedrich II. entdeckt wurde. Diese Zahnbürste ist der erste archäologische Fund aus dieser Frühphase der Mundhygiene in Berlin und Brandenburg. Ihr Kopf weist eine Gesamtlänge von 9,3 cm auf und ist mit 19 konischen Löchern (Mittelreihe: 7; Außenreihen je 6) versehen, die wohl Schweineborsten aufnahmen (Abb. 4).



Abb. 4. Zahnbürste vom Neuen Palais – war dies die Zahnbürste vom Alten Fritz? (Foto: Kay-Uwe Uschmann).

Deren Reste sind noch im Inneren erkennbar und stünden möglicherweise für weitere Untersuchungen zur Verfügung. Wie die grünliche Verfärbung des Knochens erkennen lässt, scheinen die Schweineborsten mit dünnem Kupferdraht zusammengebunden und dann auf der Rückseite der Bürste fixiert gewesen zu sein. Auffällig sind Unregelmäßigkeiten (mögliche Bisspuren?) auf den Schmalseiten des Bürstenkopfes. Eine Außenkante ist dabei stärker abgearbeitet. Der Bürstenkopf ist oben etwa 1,1 cm breit und verläuft leicht konisch in Richtung Stiel und verschmälert sich auf 0,9 cm. Generell ist der Knochen 1–2 mm stark ausgearbeitet. Die wellenförmige Ausgestaltung des dünnen Griffes mit Fingermulden ermöglichte eine Handhabung zwischen den Fingerspitzen. Die Schmalseiten sind leicht gefasst. Der Griff läuft in einem halbmondförmigen Haken aus, der durch eine kleine Kerbe von den Griffmulden abgesetzt ist. Durch seine bräunliche Verfärbung setzt er sich leicht vom Rest ab. Vermutlich wurde er stärker genutzt.

Beispiele für Zahnpflege mit solchen Hilfsmitteln gibt es schon lange, u. a. aus dem arabischen Raum (Laessig und Müller 1999). Wahrscheinlich entwickelte in Deutschland Christoph von Hellwig aus Bad Tennstedt um 1700 die erste, für die Zahnpflege gedachte Spezialbürste. Ihm zu Ehren befindet sich in seiner Heimatstadt ein Zahnbürsten-Denkmal.

Im Zeitraum zwischen 1700 und 1780 scheint sich die Herstellung von Zahnbürsten auf Einzelstücke beschränkt zu haben, die man je nach Bedarf im Auftrag herstellte. 1749 wird die Zahnbürste im „Universallexikon aller Wissenschaften und Künste“ (herausgegeben von Johann Heinrich Zedler) zum ersten Mal benannt und beschrieben. 1780 wurde schließlich von dem Engländer William Addis die erste Firma gegründet, die Zahnbürsten professionell aus Kuhknochen herstellte.

Lediglich zwei weitere Funde barocker Zahnbürsten sind bisher aus Deutschland bekannt. Eine davon wurde 2003 in Minden bei der Untersuchung eines ehemaligen Hospitalstandortes in der heutigen Innenstadt gefunden. Diese Zahnbürste war aus Tierknochen gefertigt und hatte einen wellenförmigen Griff mit einem Ohrlöffel an dessen Ende. Die Bürste war einst – wie wohl auch unser Fund – mit Schweineborsten bestückt. Es stammt aus einer Fundschicht, die in das 17. oder frühe 18. Jh. datiert (Pesch 2005). Das zweite Stück entstammt einer geplanten Auffüllschicht des fortgeschrittenen 18. Jahrhunderts, die ebenfalls 2003 bei der archäologischen Untersuchung im Hinterhof eines barocken Palais in Quedlinburg, direkt unter einem frühbarocken Pflaster freigelegt wurde. Im weiteren Fundspektrum boten Tonpfeifen einer Goudaer Manufaktur zusammen mit einer preußischen Münze und zeittypischer Keramik die Basis für eine chronologische Zuordnung in die zweite Hälfte des 18. Jhs. Auch diese Zahnbürste war aus Tierknochen hergestellt worden (Schlegel 2022).

Die zeitliche Zuordnung dieser beiden Zahnbürstenfunde legt eine Zuweisung unseres Stücks in das 3. Viertel des 18. Jahrhunderts nahe. Aus dieser Zeit ist nur von sehr wenigen Menschen der Besitz und Gebrauch einer Zahnbürste historisch überliefert. Es handelte sich dabei generell um ausgewählte Mitglieder der europäischen Kaiser- und Königshäuser.

Allerdings legt der Fund in Minden, der im Zusammenhang mit einem alten Hospitalstandort zu sehen

ist, nahe, dass wir auch mit einer Verwendung von Zahnbürsten bei bürgerlichen, medizinisch gebildeten Menschen rechnen sollten.

Die Zahnbürste vom Neuen Palais, möglicherweise ein royales Objekt, welches in die Zeit um 1760–1770 datiert, ist bedeutend, da die Fundumstände durchaus eine Zuordnung zum preußischen König Friedrich II. persönlich nahelegen können. Er besaß damals als einziger deutscher Monarch mit Philipp Pfaff (1713–1766) einen persönlichen Hofzahnarzt. Dieser war zugleich einer der renommiertesten Zahnärzte seiner Zeit. Philipp Pfaff praktizierte in Berlin und schrieb dabei das in seiner praktischen Arbeit gesammelte Wissen auf. Durch sein umfangreiches Lehrbuch „Abhandlung von den Zähnen des menschlichen Körpers und deren Krankheiten“ von 1756 gilt er als der Begründer der wissenschaftlichen Zahnmedizin in Deutschland. Dieses Buch legte er Friedrich II. persönlich vor (Will 2002). Pfaff spricht sich darin durchaus für die Zahnpflege mit Hilfsmitteln aus, seine Empfehlung der Zahnbürste ist allerdings etwas verhalten: „man bedient sich ...eines Zahnstochers..., nur rathe ich die hölzernen, oder aus einem Federkiel geschnittenen

zu gebrauchen, weil das harte Metall...dem Schmelzwerk des Zahnes nachtheilig wird...So kann ich auch nicht den öfteren Gebrauch der Zahnbürsten billigen. Denn durch das übertriebene fleißige bürsten, wird das Zahnfleisch gereißet und locker gemacht...Doch rede ich nur vom Mißbrauch der Zahnbürsten. Sie sind zur Reinigkeit nothwendig, und wenn man sich derselben alle 14 Tage bedient: so kann ich es wohl passieren lassen“ (zitiert nach Will 2002). Bekannterweise verachtete Friedrich II. Ärzte und ob er auf die Ratschläge von Philipp Pfaff gehört hat, ist unbekannt. Allerdings waren gut erhaltene Zähne für ihn sehr wichtig, nicht nur, weil er gutes Essen sehr zu schätzen wusste. Besonders für sein geliebtes Flötenspiel benötigte er ein komplettes Vordergebiss, um mit einem sauberen Ansatz der Querflöte klare Töne zu modulieren. In den späten 1770er Jahren war ihm dies aufgrund des schlechten Zustands seiner Zähne tatsächlich nicht mehr möglich, was die abendlichen Flötenkonzerte in Sanssouci zum Erliegen brachte (Büsching 1788, zitiert nach Koch 2012). Seine Totenmaske lässt erkennen, dass ihm im hohen Alter zwei Vorderzähne fehlten (Will 2002).

ZUSAMMENFASSUNG

Die in den barocken Abwasserkanälen des Neuen Palais in Potsdam aufgefundenen Obstreste gehören zu den wenigen direkten materiellen Hinterlassenschaften der Esskultur am Hof Friedrichs II. Der Fund einer zu diesem Zeitpunkt noch selten verwendeten Zahnbürste ist mit dem damals den reichen Bevölkerungsschichten vorbehaltenen starken Konsum von Zucker im Zusammenhang zu sehen. Wie die Obstreste zeugt sie von einem Leben im Luxus, das mit hohem Einsatz

von Energie und der Ausbeutung von schlechter gestellten Bevölkerungsschichten ermöglicht wurde. Gerne mokieren wir uns heute über solche feudalen Lebenswelten. Dabei machen wir es selber nicht anders. Frisches Obst zu allen Jahreszeiten ist heute keine königliche Ausnahme, sondern im globalen Norden eine Selbstverständlichkeit. Und genau wie beim Preußenkönig zahlen für unser gutes Leben andere, die daran nicht teilhaben, den Preis.

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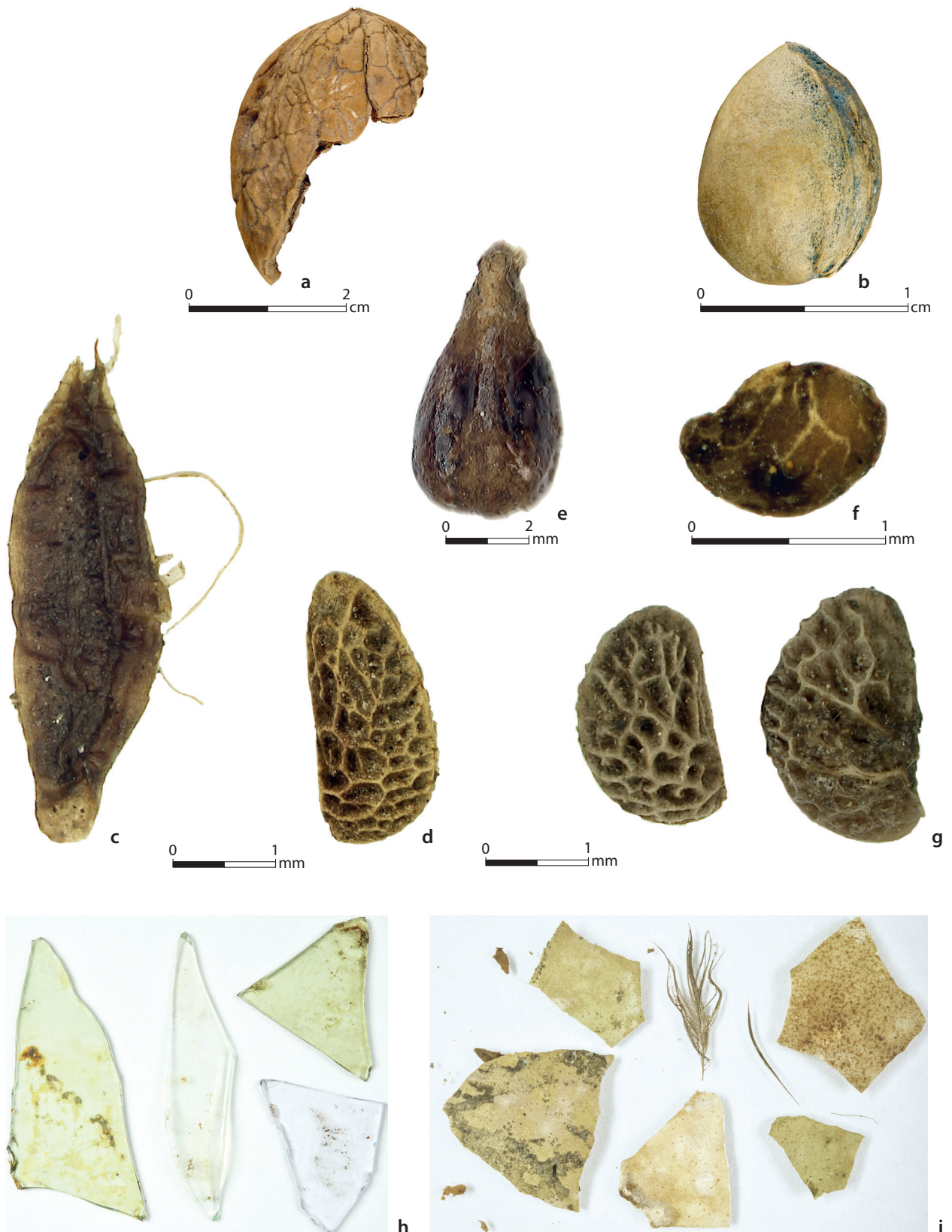
(SPSG) stellte freundlicher Weise Literatur zur Verfügung. Sabine Uschmann war mit ihrer kritischen Durchsicht des Manuskripts und ein/e anonyme/r Reviewer/in mit sachdienlichen Hinweisen eine große Hilfe.

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Tafel 1. Einige Funde von der königlichen Tafel aus der Verfüllschicht des Kanals: **a** *Juglans regia*; **b** *Prunus avium*; **c** *Carum carvi*; **d** *Rubus idaeus*; **e** *Vitis vinifera*; **f** *Fragaria sp.*; **g** *Rubus fruticosus*; **h** Glasscherben (von Weingläsern?); **i** Eierschalen und Feder (Fotos: **a–b** Michael Hochmuth; **c–g** Viola Podsiadlowski; **h–i** Karin Sommer, bearbeitet von Gabriel Graf; Grafik: Karin Winter).

„Erbarme die Hesse komme!“

Soziale und ökonomische Differenzierung an der hessisch-westfälischen Grenze

Fritz Jürgens

KEYWORDS: *cultural differentiation, border, conflicts, diachronic, regional*

Zusammenfassung

Die Bildung von (kulturellen) Gruppen stellt seit jeher einen wesentlichen Bestandteil archäologischer Arbeiten dar. In dieser Regionalstudie wird der hessisch-westfälische Grenzraum untersucht, der sich in der Gegenwart in vielerlei Hinsicht als stark konträrer Raum darstellt, was sich archäologisch im prähistorischen Kontext jedoch nicht fassen lässt. In dieser

diachronen Studie von dem Neolithikum bis in die Neuzeit, soll die kulturelle Differenzierung in dieser Region näher untersucht. Hiermit soll evaluiert werden, ob und ab wann eine Differenzierung der beiden Räume fassbar ist und wie sich diese darstellt. In einem weiteren Schritt werden die Mechanismen, welche zu solchen Entwicklungen führen, identifiziert.

Abstract

The formation of (cultural) groups has always been an essential component of archaeological work. This regional study examines the Hessian-Westphalian border region, which in many respects presents itself as a strongly contrasting area in the present day, although this cannot be captured archaeologically in a prehistoric context. In this diachronic study from the Neolithic to modern times, the cultural differentiation in this region will be examined in more detail. The aim is to evaluate if and when a differentiation between the two areas is recognisable and how this is represented. In a further step, the mechanisms that lead to such developments will be identified. The formation of (cultural)

groups has always been an essential component of archaeological work. This regional study examines the Hessian-Westphalian border region, which in many respects presents itself as a strongly contrasting area in the present day, although this cannot be captured archaeologically in a prehistoric context. In this diachronic study from the Neolithic to modern times, the cultural differentiation in this region will be examined in more detail. The aim is to evaluate if and when a differentiation between the two areas is recognisable and how this is represented. In a further step, the mechanisms that lead to such developments will be identified.

EINLEITUNG

Der Titel zitiert den 1984 erschienenen Song „Die Hesse komme!“ der hessischen Kultband Rodgau Monotones (Abb. 1), der laut einer Pressemitteilung des damaligen hessischen Landtagsabgeordneten Tarek Al-Wazir (Bündnis 90/Die Grünen) die offizielle Hessen-Hymne darstellt (Al-Wazir 2015).

Ein wesentliches Element archäologischer Arbeit besteht darin, Fundkomplexe zu Gruppen zusammenzufassen und damit eine Differenzierung oder Hierarchisierung vorzunehmen, auf deren Grundlage dann hypothetische Einflussphären und Grenzen definiert werden. Wie aber sehen soziale und wirtschaftliche

Differenzierungen an einer historisch belegten Grenze aus? Wann beginnen sie? Auf welchen Ebenen sind sie fassbar und auf welchen nicht? Und vor allem: Wie bildet sich eine solche Grenze überhaupt heraus?

In diesem Beitrag sollen die oben genannten Fragestellungen an einem regionalen Fallbeispiel exemplarisch untersucht werden, wobei dieses nur in einer diachronen Betrachtung geschehen kann. Da sich sowohl der Jubilar, als auch der Autor, zumindest herkunftstechnisch, an einer solchen Grenze gegenüberstehen, soll also die hessisch-westfälische Grenzregion als Untersuchungsobjekt dienen. Genauer genommen geht es hier um die nordhessisch-ostwestfälische Grenze zwischen Kassel und Paderborn.

Der Autor ist sich bewusst, dass der Vergleich von prähistorischen und historischen Epochen, wie er im Folgenden gemacht wird, methodisch nicht ganz einfach ist, zumal in solch einem kompakten Beitrag. Dennoch soll dies nicht unversucht bleiben, sodass einige Gedanken möglicherweise ihren Weg in weitere Arbeiten finden.

DAS UNTERSUCHUNGSGEBIET

Das Untersuchungsgebiet liegt zentral in der Bundesrepublik Deutschland gelegen und umfasst die heutigen Landkreise Kassel und Höxter als Teile der Bundesländer Hessen und Nordrhein-Westfalen (NRW). Naturräumlich wird das Gebiet in die Warburger Börde, die sich wiederum in die Einheiten Warburger Börde, Egge und Oberwälder Land und die Westhessische Senke unterteilt. Die Warburger Börde ist eine flache Bördenebene, die von der Diemel 40 bis 60 m tief durchschnitten wird. Eine bis zu 10 m mächtige Lößbedeckung auf dem Muschelkalk prädestiniert das Areal für Ackerbau. Im Süden steigt das Gelände auf 250 bis 300 m Höhe an und geht in die Steigerplatte über, deren Relief durch ausstreichenden Wellenkalk geprägt ist. An einigen Stellen durchbrechen Basaltkuppen den Muschelkalk. Während im Diemeltal Grünland auf feuchten Böden vorherrscht, sind die Hanglagen mit Trockenrasen und Kalkbuchenwäldern bewachsen. Mit einer Ausdehnung von 15 mal 21 km Größe ist die Warburger Börde die einzige größere Ebene in dem sie umgebenen Bergland (Bürgener 1963, 87–89). Die im Süden an die Warburger Börde anschließende Westhessische Senke ist eine Folge von Niederungen und Becken, die durch flache Schwellen voneinander getrennt sind. In das Arbeitsgebiet fallen die Teilbereiche der Rötensenke



Abb. 1. Die 1984 erschienene Single „Die Hesse komme!“ der Rodgau Monotones (Rodgau Monotones/Rockport Records).

von Hofgeismar, der Westuffelner Senke und der Langen- und Staufenbergplatte. Die Rötensenke von Hofgeismar trennt sich nach Norden vom Oberwälder Land und nach Osten vom Reinhardswald ab. Es handelt sich um ein offenes, lößgefülltes Becken, das in 150 bis 300 m Höhe liegt. Durch die durchfließenden Flüsse Diemel und Esse sowie weitere Quellen sind die Täler als Auen ausgebildet. Die natürliche Vegetation besteht aus Buchenwald und Grünland. Die Westuffelner Senke liegt westlich der Hofgeismarer Senke und ist ebenfalls ein zwischen Muschelkalkplatten eingeschlossenes Becken, das mit Löß gefüllt ist. Zahlreiche Quellen sowie die Warme speisen das Becken mit Wasser und sorgen für einen hohen Grünlandanteil. Zwischen der Westuffelner Senke und der Hofgeismarer Rötensenke liegt die Langen- und Staufenbergplatte, die sich in etwa 250 bis 300 m Höhe erhebt. Diese zertalte Platte besteht aus Muschelkalk und ist mit Buchenwäldern bewachsen. In den Tälern hat sich Löß abgesetzt, aus dem sich fruchtbare Braunerden gebildet haben. Die Hänge sind teilweise mit Trockenrasen bewachsen. Durch die großflächigen Lößböden ist das Untersuchungsgebiet sehr fruchtbar und für Ackerbau geeignet, was zu einer Auf siedlung seit dem Altneolithikum führte (Klink 1969, 16–17).

VON GEMEINSAMEN WURZELN...

Die Lösssenken des untersuchten hessisch-westfälischen Grenzgebietes bilden zusammen mit den Hellwegbörden im Westen und dem Harzvorland im Osten die nördliche Lössgrenze und somit auch das nördlichste Verbreitungsgebiet der Linearbandkeramik (5600 bis 4800 v. Chr.) (Pollmann 2002, 101). Diese erste feste Besiedlung lässt sich in der Region mit der älteren Bandkeramik fassen. Bei Grabungen in Hofgeismar (Lkr. Kassel) konnten zwölf Hausgrundrisse erfasst werden, deren Fundmaterial in das junge und mittlere Flomborn datieren (Kneipp 1991, 11–16). Auch bei der Auswertung der Siedlung von Borgentreich-Großeneder (Kr. Höxter), die bei Trassenarbeiten im Jahr 1993 freigelegt und als Zentralort interpretiert wurde, konnte die ältere Bandkeramik durch Häuser mit Y-Pfostenstellung und Kämpfe mit einfach und doppelt gesetzten breiten Linien nachgewiesen werden.

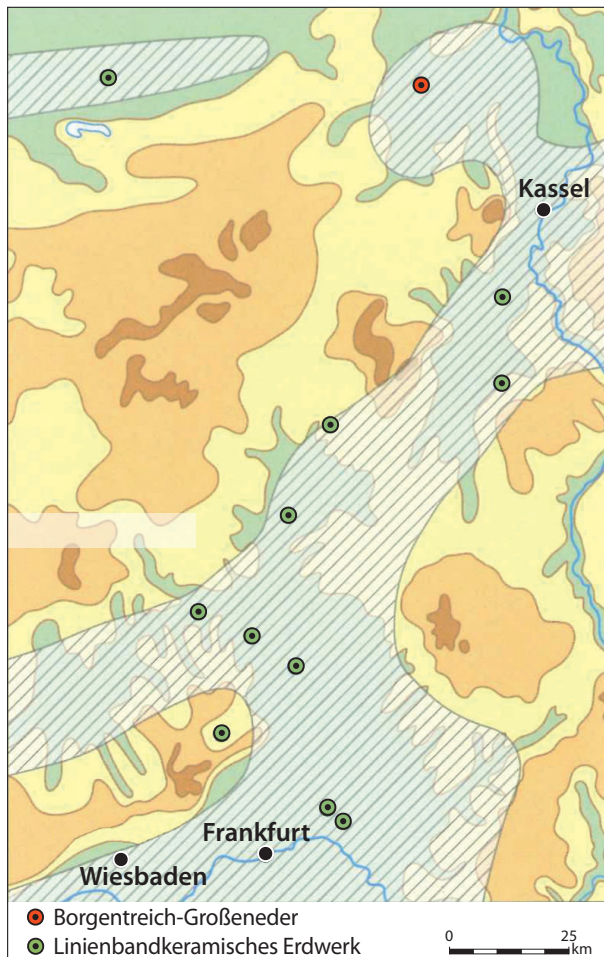


Abb. 2. Die Warburger Börde und die darin gelegene Siedlung samt Erdwerk von Borgentreich-Großeneder aus Teil der hessisch-westfälischen Bandkeramik (Pollmann 2012, 39 Abb. 4).

Absolut lässt sich diese Auf siedlung mit leider noch spärlichen ^{14}C -Daten um etwa 5200 v. Chr. fixieren (Jürgens 2019, 181). Auffällig ist, dass sich die Verzierungsstile der Keramik sehr ähneln, sodass Jürgen Kneipp (1998, Abb. 53) hieraus die Stilgruppe der hessisch-westfälischen Bandkeramik ableitete. Offenbar liefen die Besiedlung und auch der Kontakt über die südlich gelegene Wetterau ab (Abb. 2). Die westlich des Eggegebirges gelegenen und damit auch naturräumlich vom Untersuchungsgebiet abgetrennten Hellwegbörden gehören schon weitestgehend zum Einflussgebiet der rheinischen Bandkeramik und einer westlich orientierten Einflussosphäre (Kempken und Oehmen 2012, 43). Somit lässt sich der ostwestfälische, als auch der nordhessische Raum in der Bandkeramik als gemeinsame Einheit betrachten.

Aufgrund der knappen Quellenlage sind Aussagen zum Mittelneolithikum (4800–4200 v. Chr.), welches im Untersuchungsgebiet mit dem Rössener (Pollmann 2002, 123–135) und möglicherweise auch mit dem Bischheimer Kulturphänomen in Verbindung zu bringen ist (vgl.: Pfeffer 2017, 42) nicht belastbar. Umso größer ist jedoch die Datengrundlage zum Jungneolithikum, da die Michelsberger Kultur hier zahlreiche Spuren, insbesondere Erdwerke, hinterlassen hat. Hervorzuheben sind darunter die gut erforschten Anlagen von Calden (Lkr. Kassel) (Raetz-Fabian 2000) und Salzkotten-Oberntudorf (Kr. Paderborn) (Schyle 1998), sowie ein Siedlungsplatz auf dem Gaulskopf bei Warburg-Ossendorf (Kr. Höxter) (Pfeffer 2017). Auffällig ist der ähnliche Aufbau der Grabenanlagen von Calden und vom Frömkenberg bei Willebadessen-Eissen (Kr. Höxter) (Jürgens und Szillus 2019), die eine enge Verknüpfung aufzeigen. Während das frühe Michelsberg im Untersuchungsgebiet, im Gegensatz zu den westlich gelegenen Hellwegbörden nicht nachgewiesen ist, sind die michelsberger Stufen MK III und IV (nach Lüning 1968) hier fassbar, sodass mit einer Begehung ab etwa 3800 v. Chr. auszugehen ist. Diese lokale, nordhessische/ostwestfälische Ausprägung der Michelsberger Kultur bildet den Ausgang für einen Übergangshorizont, der in die ältere Phase der spätneolithischen Wartbergkultur führt, deren Entstehung sich hier abzeichnet (Raetz-Fabian 2000, 173), mutmaßlich sogar bereits ab 3800 v. Chr. (Jürgens 2018/2019, 101–105). Auch hier zeigt sich die enge Verknüpfung zwischen dem heutigen hessischen und ostwestfälischen Gebiet, die sich weiterhin an der Partizipation an denselben Austauschnetzwerken ablesen lässt. Repräsentativ hierfür ist die Verbreitung von Beilen aus „Wiedaer Schiefer“. Dieses Material aus dem Nordharzvorland wurde nur zwischen etwa 3700 bis 2800 v. Chr. genutzt und hat einen klar umrissenen

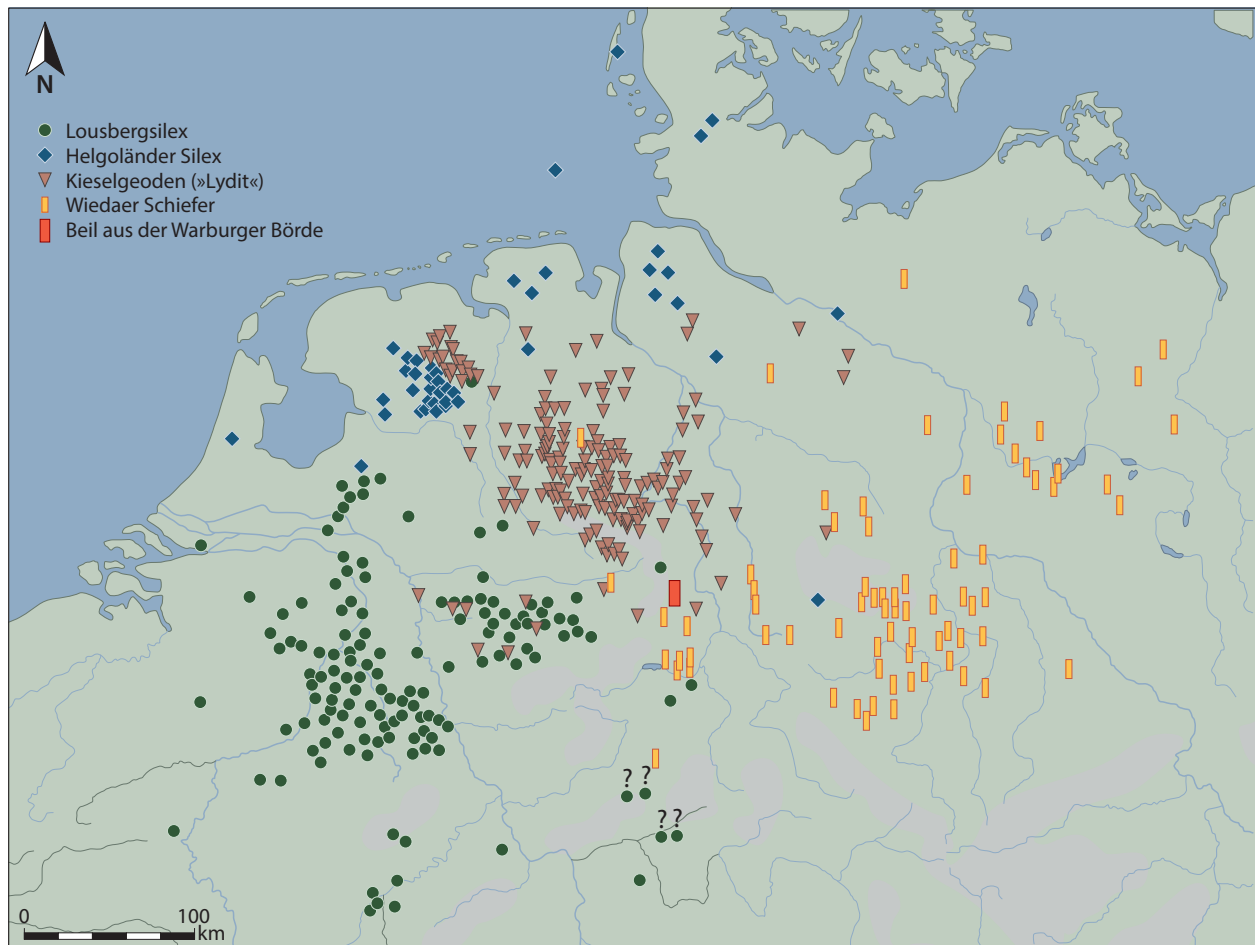


Abb. 3. Nordhessen und Ostwestfalen als Teil des Distributionsgebietes von Beilen aus „Wiedaer Schiefer“. Der rote Fundpunkt markiert ein Beil aus der Warburger Börde (nach Knoche 2008, 194 Abb. 5.47).

Distributionsraum, der das Havelland, das Mittelbe-Saale-Gebiet und Hessen umfasst (Müller 2006, 111). Dieser hessische Distributionsschwerpunkt bezieht auch die Warburger Börde mit ein. Als westliche Grenze der Verbreitung von „Wiedaer Schiefer“ kristallisiert sich das Eggegebirge heraus (Abb. 3) (Jürgens 2018). Auch das sonstige lithische Formenspektrum variiert zu beiden Seiten des Eggegebirges. So überwiegen westlich die Pfeilschneiden gegenüber den Pfeilspitzen, während es im Osten umgekehrt ist (Rinne 2001, 78, Abb. 4), weshalb hier auch die Grenze zwischen der norddeutschen Trichterbecher- und der hessischen Wartbergkultur gesehen wird (Günther 1986, 93–94). Die Wartbergkultur, die durch ihre gut überlieferten Galeriegräber samt Inventaren auch in der Warburger Börde sicher nachweisbar ist, wird somit auch als hessisch-westfälische Megalithik bezeichnet (Schierhold 2012), was wiederum die starke Verbindung dieser beiden Regionen zum Ausdruck bringt.

So groß die Quellenbasis und deren Aussagekraft für die soziale Differenzierung im hessisch-westfälischen

Grenzgebiet während des Jung- und Spätneolithikums ist, desto geringer ist sie für das Endneolithikum. So liegen hier nur vereinzelte und meistens Einzelfunde ohne Kontext von schnurkeramischen Bechern oder Glockenbechern vor (Pollmann 2002, 186–193), die keine näheren Aussagen über das Verhältnis zwischen den Regionen ermöglichen.

Für die Bronzezeit liegen wiederum zahlreiche Bestattungen in Form von Flach- und Hügelgräbern inklusive Beigaben vor. Beispiele hierfür sind auf hessischer Seite das Gräberfeld von Vollmarshausen oder die Grabhügelgruppen von Wolfhagen, Staufenberg, Niestetal-Heiligenrode, Liebenau und auch solche südwestlich und nordöstlich von Breuna (alle Lkr. Kassel) (Adler *et al.* 1986). Auch auf westfälischer Seite fanden sich bis heute zahlreiche Bestattungen. Bei der Analyse und dem Vergleich der Inventare zeigt sich, dass die Mobilität und der Austausch in der Bronzezeit, im Gegensatz zum Neolithikum stark zugenommen hat. So lassen sich weitreichende Beziehungen feststellen. Für den ostwestfälischen Raum lassen sich

kulturelle Verknüpfungen zum nordwestlich gelegenen Sögel-Wohldde-Kreis, später auch wieder vermehrt nach Nordhessen nachweisen (Herring 2004, 13). Diese südliche Anknüpfung scheint sich zu festigen, da die Warburger Börde in der jüngeren Bronzezeit wiederum zur

niederhessischen Kulturgruppe gezählt wird (Koopmann 2004, 48, Abb. 32). In der Eisenzeit können der hessische und der ostwestfälische Raum wiederum gemeinsam dem südlich gelegenen Latènekreis zugerechnet werden (Bérenger 2004a, 101).

...ZU GETRENNTEN WEGEN

Wie in den vorausgegangenen Ausführungen ersichtlich können das nordhessische und das ostwestfälische Gebiet der Warburger Börde über tausende von Jahren durch nahezu die ganze Prähistorie als Einheit betrachtet werden. Schaut man sich jedoch die rezente Situation an, stellt man fest, dass sich beide Regionen bis heute konträr entwickelt haben. Wie einleitend bereits erwähnt, handelt es sich um zwei getrennte politische Einheiten, die Bundesländer Hessen und Nordrhein-Westfalen. Doch die Differenzen zwischen Nordhessen und Ostwestfalen sind weitaus multidimensionaler. Die Grenze zwischen beiden (Land)Kreisen und Bundesländern bildet gleichzeitig auch eine Konfessionsgrenze. Während der hessische Raum weitgehend protestantisch geprägt ist, ist man in Nordrhein-Westfalen überwiegend katholisch, was natürlich ebenfalls Folgen, etwa auf begangene Feiertage, jedoch auch auf die regionale Wirtschaft hat. Aus eigenen Erfahrungen weiß der Autor, dass man in Ostwestfalen zum Einkaufen lieber in das katholische Paderborn, anstatt in das protestantische Kassel fährt, obwohl die Distanz gleich und das Kasseler Angebot sogar größer ist.

Neben den kirchlichen Feiertagen unterscheiden sich auch die sonstigen Brauchtümer und Feste. In Ostwestfalen und darüber hinaus im gesamten westfälischen Raum hat nahezu jedes Dorf seinen eigenen Schützenverein bzw. eine Schützenbruderschaft, die, oftmals jährlich, ihr Schützenfest feiert. Eines, wenn nicht sogar das wichtigste Event des Jahres (Bennholdt-Thomson 2000), während man im Nordhessischen die Kirmes begeht, die auf die Kirchweihfeste zurückgeht und von den dörflichen Burschenschaften, oder kurz Kirmesburschen, ausgerichtet wird (Burschenschaft „Club Sonnenschein“ 2016).

Weiterhin bildet die Landesgrenze auch eine Sprachgrenze. Beispielsweise wird die Uhrzeit nördlich der Grenze in Westfalen etwa mit „Viertel nach zehn“ oder „Viertel vor elf“ angegeben, während südlich in Nordhessen die Verwendung von „Viertel elf“ oder „Dreiviertel elf“ noch verbreitet ist (Eichhoff 1977, 40). Auch gebräuchlich ist dort die Verwendung von „als“ im Sinne von „andauernd“ (Paul 1896, 15). Eine weitere sprachliche Eigenheit, diesmal auf der westfälischen Seite ist auch archäologisch interessant. Besonders in den älteren Bevölkerungsgruppen ist dort die Bezeichnung „Chatten“ (ausgesprochen: „Katten“) noch als

leicht verächtliche Bezeichnung für die Hessen in Gebrauch. Ein Wehrturm der Warburger Stadtbefestigung (Kr. Höxter) wird Chattenturm genannt, da er den Blick auf die hessische Grenze gewährt (Abb. 4; Nolte 1986, 165) und in Hausnamen, etwa in Borgentreich (Kr. Höxter) ist teilweise der Namensteil Katten gebräuchlich, was möglicherweise auf ursprünglich einmal aus Hessen zugezogene Familien hinweist. Der Begriff „Chatten“ auf den mitunter auch der Name „Hessen“ zurückgeführt wird (Wagner 2011, 277–280), soll sich vom germanischen Volksstamm der Chatten ableiten, die Tacitus in seiner „Germania“ beschreibt. Diese sollen im Gebiet des heutigen Hessens gelebt und sich besonders durch Disziplin, ihre Stärke und nicht zuletzt ihre Haarpracht hervorgetan haben (Tacitus 2001, 30–31).



Abb. 4. Der sogenannte Chattenturm der Warburger Stadtbefestigung (Foto: Wilhelm Thomas Fiege).

Kulinarisch zeichnet sich entlang der Diemel, an der auch die hessisch-westfälische Grenze verläuft, ebenfalls eine Differenzierung ab. In Nordhessen bildet die Ahle Wurst die regionale Fleischdelikatesse. Hierbei handelt es sich um eine luftgetrocknete Rohwurst, aus schlachtfischem Schweinefleisch hergestellt, welcher im Februar 2023 von der Europäischen Union die geschützte geografische Angabe bestätigt wurde (EUR-Lex 2023). In Westfalen wiederum ist es die Mettwurst, bei der es sich ebenfalls um eine luftgetrocknete Rohwurst handelt (Baier *et al.* 2005, 21).

Dies stellt nur einen kleinen Überblick über die Differenzen in den unterschiedlichen, wirtschaftlichen, sozialen und kulturellen Sektoren dar, der sicherlich noch um zahlreiche Aspekte ergänzt werden könnte. Wie und wann kommt es jedoch zu einer so konträren Entwicklung, wo sich die Region, wie im Vorfeld gezeigt, über Jahrtausende so einheitlich entwickelt hat? Selbstverständlich ist es zu kurz gegriffen die aktuelle Grenzziehung und die sich daran abzeichnende Differenzierung nur als Ergebnis der Auflösung des Freistaats Preußen und der Gründung der Bundesrepublik Deutschland im Jahr 1949 zu sehen. Die Wurzeln hierfür reichen viel weiter zurück.

Wie erwähnt gibt es seit der Zeitenwende schriftliche Hinweise über die Bevölkerung im Untersuchungsgebiet, wobei diese recht spärlich sind und keine belastbaren Aussagen über genauere Stammes- bzw. Gebietsgrenzen zulassen. Eine detailliertere Überlieferung setzt erst mit dem Frühmittelalter ein. Mit der Ausbreitung der Sachsen im 7. Jh. wird die Entstehung des sogenannten sächsischen Hessengaus in Verbindung gebracht, der sich über das Gebiet des heutigen Nordhessen erstreckt haben soll und auch die Warburger Börde beinhaltete. Diese Einheit der Gebiete hielt sich auch durch die fränkische Zeit bis in das 11. Jh. (Wenck 1903, 227–257). Ab diesem Zeitpunkt zerfiel der Gau zunehmend. Schon zu Lebzeiten vermachte Graf Dodiko seinen Besitz, der das Gebiet im nördlichen Hessengau um Warburg herum, dem Bischof von Paderborn. Nach dem Tod Dodikos im Jahr 1020 n. Chr. bestätigte Kaiser Heinrich II. diese Schenkung und übertrug dies im Jahr 1021 n. Chr. an Bischof Meinwerk (Irsigler 1976/77). Somit kristallisieren sich dynastische Herrschaftverschiebungen, sowohl in Form von Vererbungen, als auch Kriegen, als Ursachen für die Trennung des Untersuchungsgebietes in unterschiedliche politische Einheiten heraus. Diese sind eine Entwicklung des Hochmittelalters, in dem sich im Rahmen des inneren Landesausbaus zahlreiche Grafschaften herausbildeten und das Gebiet so zerteilten. Das westfälische Gebiet liegt in den folgenden Jahrhunderten in der Einflussphäre der Bistümer Paderborn, Köln und Moers, die teilweise konkurrierten, sodass die Besitzrechte häufig wechselten, jedoch

immer im Westfälischen blieben (Kindl 1980, 93–99). Das nordhessische Gebiet, der sogenannte fränkische Teil des Hessengaus ging als Reichslehen an verschiedene Grafengeschlechter und wurde im 12. Jahrhundert an die Ludowinger als thüringisches Adelsgeschlecht vererbt. Im Thüringisch-hessisch Erbfolgekrieg (1247–1264) wurde das hessische Gebiet abgespalten und nun als Landgrafschaft Hessen eigenständig, ab 1291 als Reichslehen (Ilgen und Vogel 1883). Somit war die dynastische Verteilung, die sich mit einigen Änderungen immer noch in den heutigen Bundesländern abzeichnet im 13. Jahrhundert vollzogen. Diese Gebietsansprüche und deren Grenzen festigten sich im Laufe der Zeit. Dies manifestiert sich, nun auch archäologisch fassbar, mit der Errichtung von Landwehren. Hierbei handelt es sich um Wall-Graben Systeme, oftmals verstärkt mit dichten Hecken und Wachtürmen, den sogenannten Warten (Knepe 2007). Auch im Untersuchungsgebiet lassen sich solche Landwehrsysteme an vielen Stellen nachweisen, sei es durch archivalische Quellen oder als erhaltene Bodendenkmäler. Solche im Umfeld der nordhessischen Städte Hofgeismar, Grebenstein und Immenhausen kartierte Friedrich Pfaff bereits im Jahr 1910 (Sippel 2014, 283, Abb. 3). Bei diesen Landwehren konnte es sich sowohl um Stadtlandwehren handeln, die den Besitz einer einzelnen Stadt umwehrten, oder aber um sogenannte Gebiets- oder Territoriallandwehren, die größere Ländereien einschlossen. Die Entwicklung einer solchen lässt sich an den (ehemaligen) Städten Borgentreich und Borgholz (beide Kr. Höxter) nachverfolgen. In einer Urkunde die auf den 13. Oktober 1429 datiert, regelt der Bischof von Paderborn mit den Städten die Errichtung einer Territoriallandwehr als östliche Befestigung seiner Besitzungen. Hierfür griff er auf die bereits bestehenden Standlandwehren von Borgentreich und Borgholz zurück, die er im Osten mit einem Doppelwall verbinden und im Süden verlängern ließ. Weiterhin ordnete er die Errichtung zwei weiterer Warten zur Verteidigung der Landwehr an (Abb. 5). Diese bestanden aus einem steinernen Turm mit einer Höhe von 60 Fuß und einem Durchmesser von 20 Fuß, der wiederum durch eine 20 Fuß hohe Mauer samt vorgelagertem Graben umschlossen und geschützt war (Giefers 1881, 178–180). Reste einer dieser Warten, der sogenannten Stumpfen Warte sind bis heute in Form eines Erdhügels auf der Rotenbreite, nordöstlich von Borgentreich erhalten (Kindl 1980, 99; Jürgens 2014, 22–25). Eng mit diesem Ausbau der Landesverteidigung im Spätmittelalter geht auch die Gründung der Schützenvereine einher. Diese stellten sich aus Bürgern zusammen, die für die Verteidigung der Städte und des Territoriums ausgebildet wurden. Die St. Sebastians-Schützenbruderschaft Borgentreich hat einen der ältesten erhaltenen Schützenbriefe, der auf das Jahr 1502 datiert, wobei das Alter der Bruderschaft weitaus

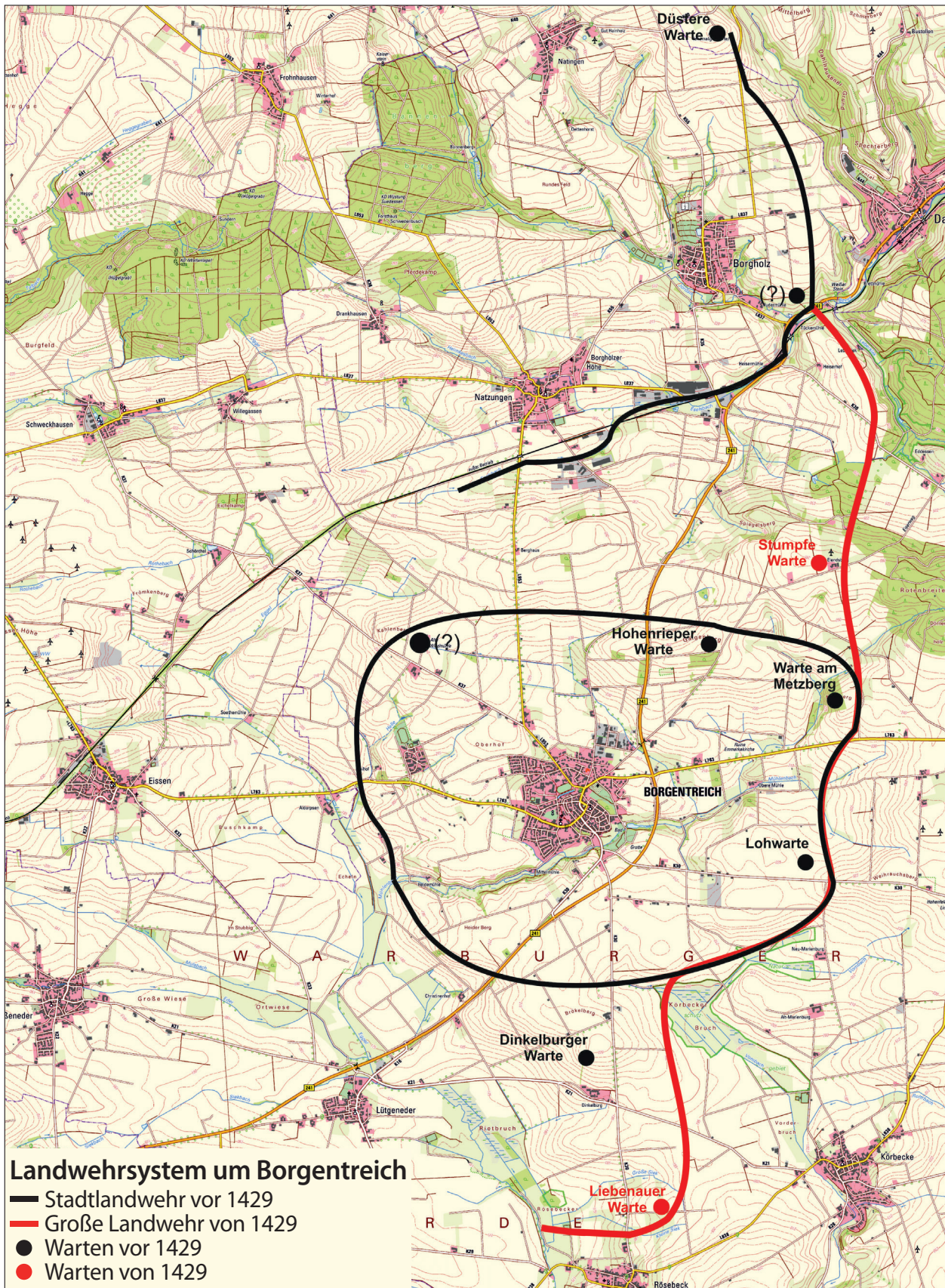


Abb. 5. Die Entwicklung und der Aufbau des Landwehrsystems um die Städte Borgentreich und Borgholz (Kartengrundlage: Geobasis NRW).

älter sein dürfte. In Artikel III wird geregelt, dass jeder mit einem guten Feuerrohr oder Flinte und Seitengewehr samt einem Pfund Pulver und dem dazu nötigen Lot ausgerüstet sein sollte, um die stetige Einsatzbereitschaft zu sichern (Mürmann 1980a, 337–338). Auch das noch heute stattfindende Schützenfest, die Schützenbruderschaften existieren nach wie vor, bzw. wieder (Dohmann 1980, 322–325), hat seinen Ursprung in den Schießwettbewerben zur Ausbildung der bürgerlichen Schützen.

Ein weiterer und für die soziale Differenzierung wohl folgenschwerster Schritt vollzog sich im Jahr 1526. Nachdem 1520 die ersten Pfarrer die lutherischen Lehren in Hessen verbreiten und sich auch am Hof schon Anhänger der Reformation fanden, werden bereits 1526 die Grafschaften Waldeck und Nassau-Weilburg sowie die Landgrafschaft Kassel auf Willen ihrer Obrigkeiten reformiert (Sohm und Franz 1957). Diese Reformierung schlug sich somit auch auf sämtliche Untertanen nieder und ist bis heute in einer mehrheitlich protestantischen Bevölkerung in Nordhessen gegenüber einer mehrheitlich katholischen Bevölkerung in Westfalen, spürbar.

UND EINER GEMEINSAMEN ZUKUNFT?

Ebenfalls äußere Einflüsse führten dazu, dass es Anfang des 19. Jahrhunderts kurzzeitig nach einer gemeinsamen Zukunft des Untersuchungsgebietes aussah. Nach dem Frieden von Tilsit im Jahr 1807 legte Napoleon Bonaparte zahlreiche Grafschaften und Fürstentümer, darunter das Hochstift Paderborn und das Kurfürstentum Hessen zum Königreich Westphalen beziehungsweise Royaume de Westphalie zusammen. Zum König wurde Jérôme Bonaparte, der jüngste Bruder Napoleons. Als Residenzstadt wurde Kassel ausgewählt. Diese gemeinsame dynastische Periode währte jedoch nur sechs Jahre bis zur französischen Niederlage in der Völkerschlacht bei Leipzig im Jahre 1813 wonach die ehemalige Aufteilung wiederhergestellt (Berding 1985; Bartsch 2008) und Westfalen eine Provinz des Königreichs, später Freistaats Preußen wurde. Kurhessen wurde 1866 ebenfalls als Provinz Hessen-Nassau vom Königreich Preußen annektiert und nach dem Zweiten Weltkrieg, ebenso wie Nordrhein-Westfalen als Bundesland im Rahmen der föderalen Struktur der Bundesrepublik Deutschland als Bundesland eigenständig.

Die vorangegangene, zugegebenermaßen durch dieses Format recht kompakte Darstellung zeigt, dass das untersuchte Gebiet, die Grenzregion des heutigen Nordhessens und Ostwestfalens während der ganzen Prähistorie als eine Einheit gesehen werden kann. Dies zeigen die zahlreichen Befunde, besonders aus

Die Unterteilung des nordhessisch-ostwestfälischen Gebietes in unterschiedliche dynastische Bereiche, einer eher weltlich geprägten Landgrafschaft Hessen-Kassel und dem geistlichen Fürstbistum Paderborn, hatte jedoch nicht nur Auswirkung auf regionaler, sondern auch auf globaler Ebene. In den Wirren der zahlreichen Konflikte der Frühen Neuzeit schlossen sich die Landesherren unterschiedlichen Koalitionen an, was etwa dazu führte, dass sich Kurhessen auf Seiten Preußens und Großbritanniens und das Fürstbistum an der Seite Frankreichs im Siebenjährigen Krieg (1756–1763) gegenüberstanden (Kindel 1974). Im Rahmen dieser Auseinandersetzung fanden auch direkte Kampfhandlungen im Untersuchungsgebiet statt. So standen sich in der Schlacht bei Warburg am 31. Juli 1760 östlich der Stadt über 35.000 Truppen gegenüber, die in einer französischen Niederlage endete (Thews 2014; von Geisau 1960). Im Rahmen des Amerikanischen Unabhängigkeitskrieges (1775–1783) wiederum überließ Landgraf Friedrich II. von Hessen Kassel der britischen Seite über 12.000 hessische Soldaten für den Kampf in Übersee, was etwa einem Drittel der britischen Truppen auf dem amerikanischen Kontinent entsprach (Auerbach 1996).



Abb. 6. Aufkleber der Bürgerinitiative Atomfreies 3-Ländereck e.V. auf dem Auto des Jubilars (Foto: Fritz Jürgens).

der Bandkeramik, der Michelsberg- und der Wartbergkultur. Die Trennung des Gebietes lässt sich erst und dies auch nur durch historische Quellen, für das Hochmittelalter nachweisen. Im Rahmen des inneren Landesausbaus und des sich herausbildenden Adels wurden die Gebiete in unterschiedliche dynastische Einheiten getrennt. Dies führte zu den zahlreichen Differenzierungen, die sich in der Folge zeigten, besonders etwa der unterschiedlichen Konfessionalisierung. Unbeantwortet muss an dieser Stelle die Frage bleiben, wie sich diese mittelalterlichen und frühneuzeitlichen Entwicklungen auf die Materialität auswirken und so auch in rein archäologischen Studien sichtbar würden. Dies wäre ein äußerst lohnenswertes Forschungsziel

für zukünftige Untersuchungen, da insbesondere dynastische Differenzierungen auch für prähistorische Epochen anzunehmen sind und somit zur Klärung archäologischer Quellen beitragen können.

Um noch einmal zum Forschungsgegenstand der hessisch-westfälischen Grenze zurückzukehren: Trotz aller Unterschiede und Differenzen gibt es auch zahlreiche gemeinsame Bestrebungen. Ein Beispiel hierfür ist etwa der gemeinsame Kampf der Bürgerinitiative Atomfreies 3-Ländereck e.V. gegen ein geplantes Bereitstellungslager für Atom Müll auf dem Gelände des ehemaligen Kernkraftwerkes Würgassen (Atomfreies DLE 2023), deren Aufkleber sich mitunter selbst auch auf Autos in Kiel wiederfinden (Abb. 6).

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Time to Grasp the Nettle – Das Nutzungspotential der Brennnessel

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KEYWORDS: *nettle, potential usage, experimental archaeology*

Zusammenfassung

Wo Menschen gelagert und gesiedelt haben, tauchen früher oder später Brennnesselbestände auf. Die Blätter und Nüsschen dieser weit verbreiteten Wildpflanze, die zum Gedeihen Licht und nährstoffreiche Böden benötigt, stellen ab dem zeitigen Frühjahr vitamin- und mineralstoffhaltige Nahrungsmittel dar. Wie Experimente zeigen, können aus den Fasern ihrer Stängel feine Schnüre gedreht, Netze geknüpft und feine Stoffe gewoben werden. Im archäologischen Befund

sind Beweise für diesen Gebrauch der Brennnessel bislang eher selten, was mit der Schwierigkeit der Zuordnung von Fasern zu einer bestimmten Pflanzenart zusammenhängen kann. Dieser Kurzbeitrag soll die Faszination, die mit dieser Wildpflanze verbunden ist erwecken und dazu beitragen, archäologische Funde aus Brennesselfasern anatomisch leichter bestimmen zu können.

Abstract

Wherever humans have camped and settled, stinging nettle stands will sooner or later appear. The leaves and nutlets of this widespread wild plant, which needs light and nutrient-rich soil to thrive, provide vitamin and mineral-rich food already from early spring onwards. Experiments show that the fibres of its stems can be used to twist fine cords, to knot nets and to weave

fine fabrics. In the archaeological record, evidence of this use of stinging nettles is rather rare, which is probably due to the difficulty of assigning fibres to a specific plant species. This short article is intended to awaken the fascination that is associated with the nettle plant and to contribute to an easier anatomical identification of archaeological finds made of nettle fibres.



Abb. 1. Die Große Brennnessel (*Urtica dioica* L.) im zeitigen Frühjahr (Foto: Sabine Karg).

EINLEITUNG

Die Große Brennnessel (*Urtica dioica* L.) ist eine ausdauernde und winterharte Staude, die in allen temperierten Klimazonen Europas, Asiens und Nordamerikas weitverbreitet ist. Sie überwintert als Wurzelstock aus dem die ersten Blätter im Frühjahr sehr zeitig wieder austreiben (Abb. 1).

Basierend auf den ökologischen Zeigerwerten von Heinz Ellenberg (1974) charakterisieren Albert Reif *et al.* (1985) die Wuchsorte der Brennnessel wie folgt: sie gedeiht am besten auf neutralen aber stickstoffhaltigen, feuchten Böden. Ihr Vorkommen kann fast immer mit menschlichen Aktivitäten, die auch längere Zeit zurückliegen können, in Verbindung gebracht werden: seien es aufgelassene Lagerplätze, verlassene Viehunterstände, Gebäude, Gärten oder Grabanlagen (Abb. 2).

Die Blätter der Brennnessel stellen bereits im zeitigen Frühjahr eine wichtige vitamin- und mineralstoffhaltige Nahrungsquelle dar, die Nüsschen können im Herbst geerntet werden. Die gleichzeitige Heilwirkung beider Organe werden vielfach beschrieben (u. a. Dörfler und Roselt 1984, 296). Alle getrockneten Teile der Pflanze eignen sich vorzüglich zum Räuchern von Fisch und noch heute werden Brennnesselwurzeln in Schweden zum Färben von Ostereiern verwendet (Bredemann 1959, 118). Sie ergeben eine gelbe bis grün-gelbe Farbe. Die bis zu 2 m hohen Stängel beinhalten feinste Fasern, die zu Schnüren, Netzen und Stoffen (Abb. 3) verarbeitet werden können (Fischer 2017, 146; Hurcombe 2014, 142).



Abb. 2. Dichter Bestand der großen Brennnessel auf einer ehemaligen Schafweide (Foto: Sabine Karg).

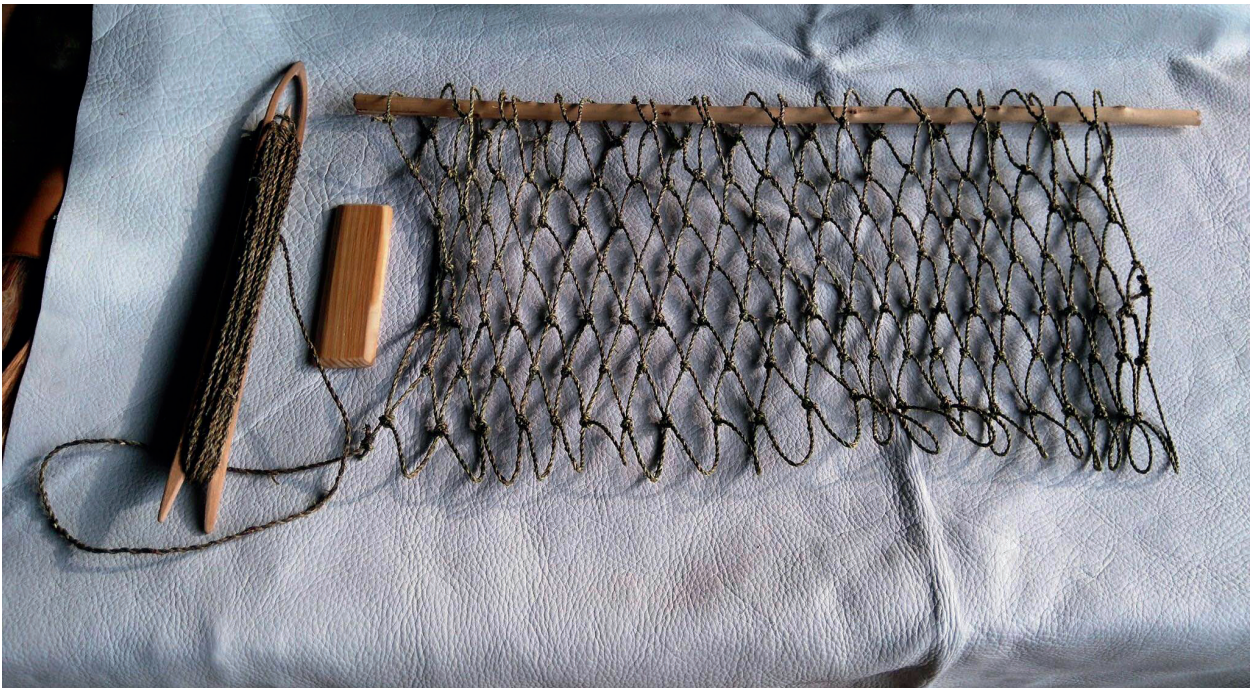


Abb. 3. Netz aus Brennesselfasern geknüpft. Rekonstruktion von Manfred Pfeifer (Foto: Manfred Pfeifer).

WOHER DER NAME BRENNNESSEL STAMMT UND WESHALB ES SO VIELE GESCHICHTEN ÜBER DIESE WILDPFLANZE GIBT

Die gesamte Pflanze ist mit Brennhaaren besetzt, deren spröde Spitzen bei unvorsichtiger Berührung leicht abbrechen und dann — wie jeder von uns weiß — brennende Schmerzen auf der Haut verursachen, daher stammt der Name „Brennnessel“ (Marzell 1979, 914). Die Wortsilbe *Nessel* steht möglicherweise im Zusammenhang mit *Netz* wegen der Verwendung der Bastfasern zu Gespinsten (Hegi 1981, 139).

Zahlreiche Geschichten zeugen von der Tradition, aus Nesselfasern Hemden zu weben. So erfahren wir u. a. im Märchen „Die wilden Schwäne“ des dänischen Autors Hans Christian Andersen, das auf früheren Versionen von u. a. der Gebrüder Grimm basiert, dass nur diejenigen Brennnesseln, die auf des Kirchhofs Gräbern wachsen, für die Gewinnung von Fasern tauglich sind. Um ihre in Schwäne verwandelten Brüder zu erlösen, musste die verstoßene Königstochter Elisa aus den Fasern der Brennnessel elf Panzerhemden mit langen Ärmeln herstellen.¹

Über eine Nesselmanufaktur, die bis 1723 in Leipzig existierte, berichtet Friedrich Tobler (1938, 77). Dort wurden aus Nesselfasern Netze und Kleidungsstoffe hergestellt bevor Baumwolle in großen Mengen importiert wurde.

In Kriegszeiten erinnerte man sich an die Tradition, aus Brennnesselfasern Stoffe herzustellen (Hald 1942, 36). So wurde in Dänemark im Jahre 1917 von der Regierung ein Nessel-Komitee eingerichtet und 10.000 Kronen für Experimente mit der Brennnesselfaser garantiert. Leider scheiterten diese Versuche an der Verarbeitungstechnik. Der sogenannte „Rottungsprozess“ gestaltete sich als zu schwierig. Nach Ende des ersten Weltkrieges zeigte dann kaum mehr jemand Interesse an dieser Pflanze. In Deutschland und in Österreich

gelang es jedoch, schöne und feine Garne aus ihren Fasern herzustellen und Versuche mit dem kontrollierten Anbau der Brennnessel wurden in diesen beiden Ländern gestartet (Tobler 1938). Nach dem zweiten Weltkrieg wurde die Brennnessel als Faserlieferant, genau wie Leinen, von billig importierten Baumwollstoffen vollständig vom Markt verdrängt. Die Forschungen über die Veredelung und den gezielten Anbau zwischen den Jahren 1927 und 1950 (Bredemann 1959) gerieten völlig in Vergessenheit. Im Zuge der Rückbesinnung auf einheimische Rohstoffe wurden in der Zwischenzeit landwirtschaftliche Versuche zum Anbau dieser nachhaltigen und vielfältig nutzbaren Pflanze, deren kultivierte Formen einen höheren Fasergehalt als die der wildwachsenden beinhalten, in mehreren europäischen Ländern erneut aufgenommen (Vogl und Hartl 2003). Es sei erwähnt, dass die Bezeichnungen „Nesselgarn und Nesselstoff“ nichts mehr mit der Brennnessel zu tun haben. Der Name wurde in moderner Zeit auf Stoffe aus anderen Materialien übertragen, wie z. B. auf Seidengewebe und Stoffe aus der Indischen Nessel Ramie (Tobler 1938, 80). Flur- und Städtenamen wie z. B. Nesselwang (im Allgäu) oder Nessel-Grund (Gemeinde Wolfshagen im Lkr. Kassel) deuten in Deutschland auf das ehemalige Vorkommen und eventuell auch auf den ehemaligen Anbau der Brennnessel in früheren Zeiten hin, wie Margrethe Hald (1942, 38) dies auch für Norwegen vermutet. Im Rahmen der aktuellen Umweltdebatte und der Ursachen, die der Stickstoffeintrag auf unsere Wälder hat, rückt die Brennnessel erneut ins Rampenlicht (Fokken 2022). Noch größere Aufmerksamkeit erhält diese Wildpflanze in sämtlichen Ratgebern, die sich mit Themen wie „länger leben und lustvoller leben“ beschäftigen (u. a. Pütz und Kirschner 2002).

WESHALB DIE BRENNNESSEL (NOCH) NICHT DEN STELLENWERT EINER KULTURPFLANZE ERLANGT HAT

Gustav Bredemann (1959, 6) beschreibt in seiner Monographie über die Große Brennnessel, dass die Stängel nur wenige Bastfasern enthalten und diese nicht wie beim Lein oder Hanf in Bündeln angeordnet sind. Bei den Nesseln liegen die Fasern +/- vereinzelt in dem aus dünnwandigen Parenchymzellen und Siebröhren bestehenden kleinzelligen Rindengewebe (Abb. 4a). Die Verarbeitung vom Stängel bis hin zum feinen Faden — respektive einem Kleidungsstück — sind ähnlich aufwändig wie die der Verarbeitung von Lein (*Linum usitatissimum* L., Karg 2013; 2022). Allerdings scheint

der Rottungsprozess von Brennnesselstängeln bislang das Hindernis für eine erfolgreiche industrielle Aufbereitung darzustellen. So betont Birte Ford (2014, 42), wie sehr das richtige Zeitmanagement des Rottungsprozesses das Ergebnis der Gewinnung von Brennnesselfasern beeinflussen kann. Bereits Eduard Hahn (1917, 329) hebt hervor, wieviel mehr Sorgfalt und Arbeit die Behandlung der Nesselfaser im Gegensatz zur Leinfaser verlangt. Experimentalarchäolog:innen beschreiben die verschiedensten potentiellen Aufbereitungsmethoden in vorgeschichtlicher Zeit (u. a. Ford 2014, 42).

1 <https://maerchen.com/andersen/die-wilden-schwaene> ; letzter Zugriff 30. Dezember 2024

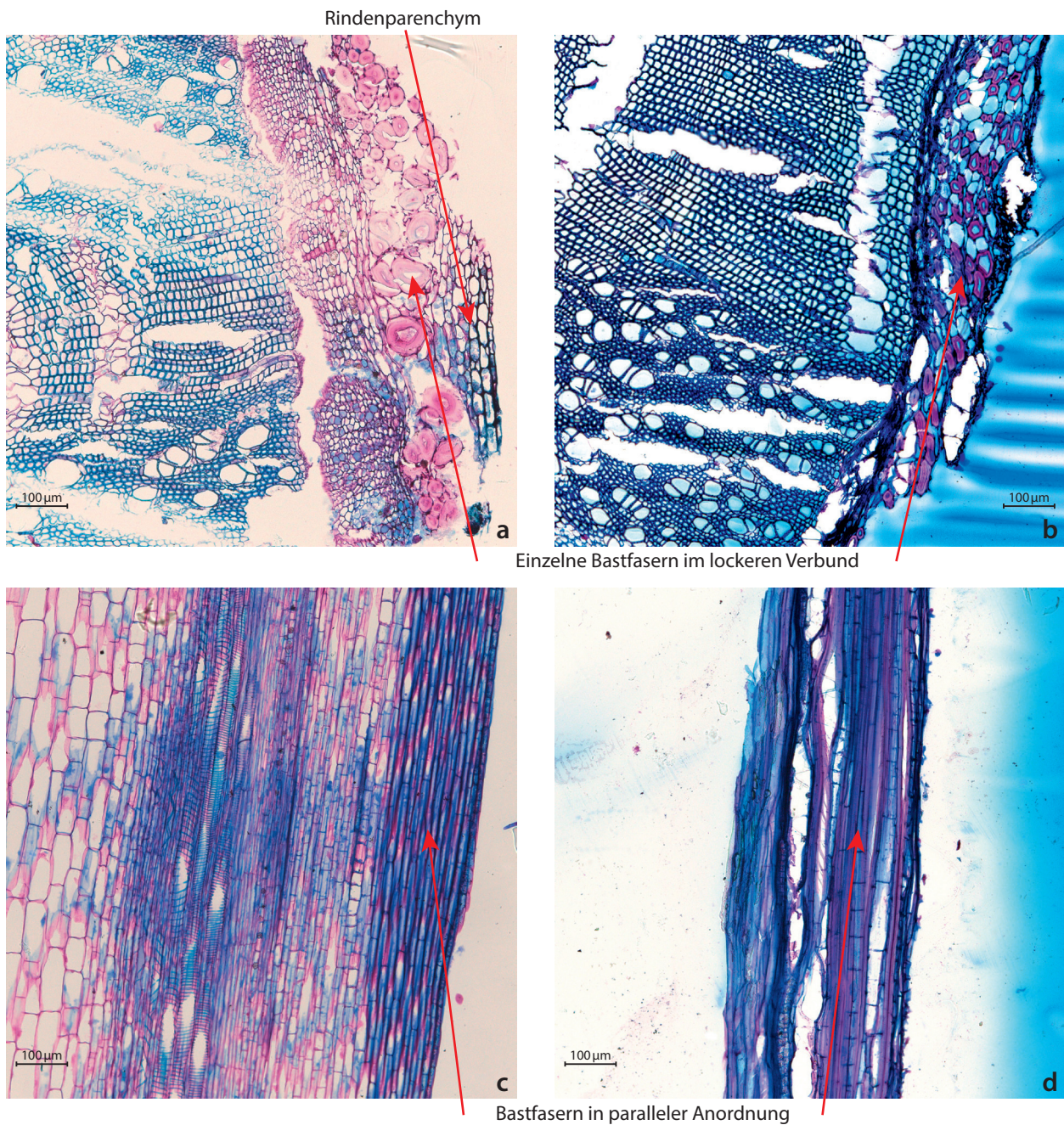


Abb. 4. **a** Querschnitt eines frischen Brennnesselstängels mit sichtbaren Bastfasern; **b** Querschnitt eines gerotteten Brennnesselstängels mit sichtbaren Bastfasern; **c** Längsschnitt eines frischen Brennnesselstängels mit sichtbaren Bastfasern; **d** Längsschnitt eines gerotteten Brennnesselstängels mit sichtbaren Bastfasern (Fotos: Eylem Koca).

ANATOMISCHE BESCHREIBUNG VON MODERNEN NESSELFASERN

Die Experimente der Textilarchäologin Ulla Mannering im Freilichtmuseum Lejre auf Seeland in Dänemark haben gezeigt, dass von Hand geerntete und verarbeitete Brennnesselstängel Faserbündel unterschiedlicher Länge liefern: 20–30 cm aber auch nur 10–15 cm oder noch kürzere unter 10 cm (Mannering 1996, 80). Nach Udelgard Körber-Grohne (1967, 162)

weisen Bastfasern der heutigen Brennnessel eine Länge von 3–10 mm und eine Breite von 21–63 µm auf. Die Autorin beschreibt, dass im polarisierten Licht eine grobe Spiralstreifung sichtbar ist, bei der die Richtung schwach wechselt und die Färbung der einzelnen Streifenpartien verschieden ist. Die Querlinien verlaufen meist wellig und durchziehen die Faser ganz

oder nur randlich. Im Phasenkontrastlicht ist die Spiralstreifung noch deutlicher erkennbar. Sie zeigt an den Querlinien eine geringfügige Verschiebung. Diese Merkmale und die größere Dicke der Fasern ermöglichen — zumindest in rezentem Zustand — eine Unterscheidung zwischen den beiden Pflanzenarten Brennnessel und Hanf. Im Rahmen des DFG Projektes der Erstautorin wurden mehrere Faserpflanzen aufbereitet und mikroskopisch untersucht. Fotografien von Dünnschnitten eines frischgeernteten und eines verrotteten Brennnesselstängels werden hier präsentiert. Mit Hilfe eines Mikrotoms (Thermo Scientific Microm HM355 S) wurden die Dünnschnitte hergestellt und anschließend mit Ruthenium und Toluidin gefärbt (Abb. 4a–d). In der frischgeernteten Pflanze (Abb. 4a) sind im Querschnitt mehrere einzelne und im lockeren Verbund liegende Fasern deutlich erkennbar. Im gerotteten Stängel fehlt die äußere Rinde des Stängels. Einzelne oder im lockeren Verbund liegende Bastfasern sind auch hier gut zu erkennen (Abb. 4b).

Im Längsschnitt sind sowohl in der frischen wie auch in der gerotteten Brennnessel die parallel angeordneten Bastfasern mit ihren von Udelgard Körber-Grohne (1967, 162) beschriebenen Querlinien sichtbar (Abb. 4c und 4d). Im Gegensatz zum Lein und Hanf bestehen die Faserbündel der Brennnessel nur aus wenigen Einzelfasern, deren Dicke der Zellwände und Durchmesser der Lumina (der innere Hohlraum der Faser) sehr unterschiedlich ausfallen können, was wohl mit dem Alter (Ausbildungsstadium) der jeweiligen Faser zusammenhängt (Karg in press).

Die Torsionsrichtung der Fasergruppen der Brennnessel wird als *rechtsläufig* (Z-Drehung) beschrieben (Körber-Grohne 1967, 161). Die einzelnen Mikrofibrillen weisen dagegen eine S-Drehung auf (Bergfjord und Holst 2010). Die Zugkraft von Brennnesselfasern ist stärker als diejenige von Hanffasern, wie Experimente von Edwin Bodros und Christophe Baley (2008, 2145) aufzeigen konnten.

ARCHÄOLOGISCHE HINWEISE ZUR NUTZUNG DER BRENNNESSEL

In zahlreichen archäologischen Fundstellen ist die Brennnessel in Form von Nüsschen nachgewiesen². In Sedimenten der mesolithischen Fundstelle Friesack in Brandenburg wurden Nüsschen der heute sehr seltenen Röhricht-Brennnessel (*Urtica kioviensis* Rogow) identifiziert (Wolters *et al.* 2005; Wolters 2016). Doch leider ergaben die wenigen Faseranalysen bislang noch keinen Beweis dafür, dass die Stängel dieser hochwüchsigen Art für eine Fasergewinnung genutzt worden sind (Gramsch und Kernchen 2023).

Nur sehr wenige archäologische Textilfunde wurden bislang als Nesselfaden oder -stoff bestimmt. Dies ist wahrscheinlich auf mehrere Gründe zurückzuführen:

- Generell erhalten sich Textilfunde nur sehr selten im archäologischen Befund.
- Archäologische Textilfunde werden meist nur magaziniert und nicht näher analysiert.
- Die Bestimmung von archäologischen Textilfunden setzt Spezialwissen und eine technische Laborausstattung sowie eine moderne Referenzsammlung voraus.

Aus der neolithischen Feuchtbodenfundstelle La Draga in Spanien, die ins 6. Jt. v. Chr. datiert, stammt ein Objekt, das höchstwahrscheinlich aus Brennnessel-

fasern hergestellt worden ist (Herrero-Otal *et al.* 2023, 7). Es handelt sich um eine Schnurrolle, die in der Nähe von drei Fragmenten eines Bogens lag. Sie war nicht mit dem Bogen verbunden, aber es wird angenommen, dass sie die Bogensehne darstellt (Piqué *et al.* 2015).

Aus Dänemark gibt es einen neubearbeiteten Altfund von 1861/62, das sogenannte Lusehøj Textil aus der Fundstelle Voldtofte auf Fünen (Thrane 1984), das in die Bronzezeit datiert. Das Textil wurde wahrscheinlich im Alpenraum hergestellt, wie die Analyse von Strontium Isotopen zeigen soll (Bergfjord *et al.* 2012). Ein weiteres kleines Knäuel aus Brennnesselgarn stammt aus der Fundstelle Nørre Sandegård auf der Insel Bornholm und datiert in die jüngere Eisenzeit. Ulla Mannering (1996, 76) beschreibt zudem einen Nachweis von Brennnesselstängeln im Schiffsfund Kvalsund in Norwegen.

Antoinette Rast-Eicher (2016, 105; Rast-Eicher *et al.* 1995) berichtet über zwei weitere archäologische Funde aus der Schweiz: einen Gürtel im frühmittelalterlichen Grab eines Mädchens in Flurlingen und einem Nesseltextil aus der mittelalterlichen Fluchtburg Malvaglia, das von Werner Schoch (1986, 93) analysiert worden ist.

2 <https://www.wikis.uni-kiel.de/archbotlit/doku.php/about>; letzter Zugriff 30. Dezember 2024

POLLENANALYTISCHE NACHWEISE

Vereinzelte aber stetig vorkommende Pollenkörner der Brennnessel sind für Norddeutschland bereits seit dem Spätglazial und dem frühen Postglazial nachgewiesen, u. a. für die Endphase des Boreals und die erste Hälfte des Atlantikums (siehe Diskussion in Brande 1980, 52). Julian Wiethold (1998, 122) erwähnt den Nachweis von Brennnesselpollen für den Zeitraum zwischen 7250–5000 v. Chr., also für das Mesolithikum Schleswig-Holsteins. Da die Pollenkörner der einzelnen *Urtica*-Arten nicht voneinander unterschieden werden können schlägt Klaus Kloss (1987) vor,

dass erhöhte *Urtica*-Werte in Pollendiagrammen aus See- oder Fließgewässern auch von der Röhricht-Brennnessel (*Urtica kioviensis* Rogow.) stammen können. Arthur Brande diskutierte bereits 1980, ob es sich im Zusammenhang mit Kurvenauschlägen von *Urtica* in Pollendiagrammen um diese Brennnesselart handeln könnte und beruft sich dabei auf die Publikation von Peter Konczak *et al.* (1968). Brennnesselpollen aus natürlichen Archiven kann demnach sowohl auf die Röhricht-Brennnessel als auch die potentielle Nutzpflanze der Großen Brennnessel verweisen.

ARCHÄOBOTANISCHE MAKRORESTE

Nüsschen der Röhricht-Brennnessel wurden in Sedimenten der mesolithischen Fundstelle Friesack im Bundesland Brandenburg von Steffen Wolters *et al.* (2005) entdeckt. Heutzutage kommt diese Pflanze in Deutschland nur sehr selten vor (Haeupler und Schönfelder 1989, 127). Es handelt sich um eine subkontinentale Stromtalpflanze, die auf feuchten Standorten entlang von Gewässern gedeiht. Sie wächst in Vergesellschaftung mit der Großen Brennnessel und ist durch ihre glänzenden Blätter aufgrund der fehlenden Borstenhaare, ihrem stattlichen Bau und der langgestielten Blätter recht leicht von ihr zu unterscheiden (Oberdorfer 2001, 321). Außerdem ist ihr Stiel nicht verzweigt. Ihre Nüsschen unterscheiden sich ebenfalls deutlich – vor allem anhand der Größe und ihrer Spindelform – von denen der anderen Brennnesselarten (Wolters 2016, 196). Die hohe Stetigkeit der Nachweise der Röhricht-Brennnessel in allen untersuchten Sedimentproben aus der Fundstelle Friesack beweist somit, dass diese potentielle Faserpflanze der mesolithischen Bevölkerung vor Ort als Rohstoff zur Verfügung gestanden hat und theoretisch für die Herstellung von Textilien genutzt werden konnte. Für welche Art von Textilien dies möglich gewesen sein könnte, wurde vom Zweitautor dieses Festschriftartikels experimentell nachvollzogen, wobei vorläufig nur die Fasern der Großen Brennnessel verwendet worden sind.

EXPERIMENTE MIT BRENNNESSELFASERN

Abbildung 3 zeigt ein aus Brennnesselfasern hergestelltes Stellnetz. Das fertige Netz misst 2,40 x 0,50 m, die Maschenweite beträgt jeweils 6 cm und die Schnurstärke misst 2,5–3,5 mm.

Aus dem Bast von 200 Brennnesselpflanzen wurde innerhalb von 40 Stunden 61 m Schnur per Hand gewirnt. Das Netz war innerhalb von 2,5 Stunden mit



Abb. 5. Bogen mit Schnur aus Brennnesselfasern bespannt. Der Bogen misst 160 cm; Rekonstruktion von Manfred Pfeifer (Foto: Manfred Pfeifer).

einer Nadel fertiggeknüpft und obwohl es mehrere Jahre lang in einem luftigen Raum mit schwankender Luftfeuchtigkeit, Kälte und Hitze ausgesetzt war, hat es sich unverändert erhalten.

Ein weiteres Experiment zeigt, dass auch ein Pfeilbogen mit einer Brennnesselschnur bespannt werden kann (Abb. 5). Dafür wurde von frischen Brennnessel-



Abb. 6. Befestigung der Schnur aus Brennesselfasern am oberen und am unteren Ende des Bogens; Rekonstruktion von Manfred Pfeifer (Foto: Manfred Pfeifer).

stängeln die Rinde mit samt den Fasern abgezogen und zum Trocknen aufgehängt. Anschließend wurden die Streifen durchgewalkt und getreten, dabei lösten sich die verholzten Teile. Die meiste Zeit nahm die Sortierung und Bündelung der Fasern ihrer Länge nach in Anspruch. Erst danach konnten die Faserbündel locker miteinander verzwirrt werden. Aus zwei

solch verzwirrten Strängen wurde anschließend eine Bogenschnur gedreht und diese dann mit Hilfe von Schlaufen (Abb. 6a–b) am Stab befestigt. Die maximale Schussweite mit diesem Bogen betrug 150 m. Dieser Versuch bestätigt die Vermutung, dass die Schnur aus der neolithischen Feuchtbodenfundstelle La Draga in Spanien als Bogenschnur gedient haben könnte.

SCHLUSSFOLGERUNG UND AUSBLICK

Die Brennnessel als ein wichtiger vorgeschichtlicher Faserlieferant sollte bei zukünftigen Materialanalysen von Textilfunden, wie sie z. B. aus der Fundstelle Friesack im Bundesland Brandenburg zahlreich geborgen worden sind, verstärkt berücksichtigt werden. Neben der Großen Brennnessel könnte entlang von Flussläufen

auch die Röhricht-Brennnessel genutzt worden sein. Vor allem dünne Schnürchen, die u. a. zur Befestigung von Angelhaken gedient haben, könnten aus den sehr reißfesten Fasern der Brennnessel gezwirnt gewesen sein. Wie eigene Experimente zeigen, sind verzwirnte Brennnesselfasern auch als Bogenschnüre tauglich.

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Population Models for the Bronze and Iron Ages – At the Early Celtic Princely Seat on the Ipf and in the Nördlinger Ries (Bavaria and Baden-Württemberg, Germany)

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KEYWORDS: population models, Bronze and Iron Age, Nördlinger Ries, Goldberg, Ipf, early celtic princely seat

Abstract

During the Bronze and Iron Ages, the Nördlinger Ries in southern Germany was densely populated with numerous lowland settlements and imposing hilltop sites such as Ipf and Goldberg. This prehistoric settlement area is ideal for the study of population development. By combining population models based on archaeological settlement data divided into several time slices and comparing them with results from archaeobotanical and archaeozoological studies, it was possible to shed

light on population development and land use during the last two millennia BCE. A settlement dynamic can be reconstructed, which is characterised by several changes and, for the first time in an Iron Age settlement area, shows a continuous development from the Late Bronze Age until the end of the *Viereckschanzen* in the 1st century BCE. These archaeological finds from the Bronze and Iron Ages raise questions about population development and size in the Nördlinger Ries.

Zusammenfassung

Während der Bronze- und Eisenzeit war das Nördlinger Ries in Süddeutschland dicht besiedelt, mit zahlreichen Tieflandsiedlungen und imposanten Höhensiedlungen wie dem Ipf und dem Goldberg. Dieses prähistorische Siedlungsgebiet eignet sich hervorragend für eine Studie zur Bevölkerungsentwicklung. Durch die Kombination von Bevölkerungsmodellen, die auf archäologischen Siedlungsdaten in mehreren Zeitscheiben beruhen, und den Vergleich mit Ergebnissen archäobotanischer und archäozoologischer Untersuchungen konnten die Bevölkerungsentwicklung und die Landnutzung in den

letzten zwei Jahrtausenden v. Chr. aufgezeigt werden. Es lässt sich eine Siedlungsdynamik rekonstruieren, die durch mehrere Veränderungen gekennzeichnet ist und erstmals in einem eisenzeitlichen Siedlungsgebiet eine kontinuierliche Entwicklung von der Spätbronzezeit bis zum Ende der Viereckschanzen im ersten vorchristlichen Jahrhundert zeigt. Diese archäologischen Funde der Bronze- und Eisenzeit werfen die Frage nach der Bevölkerungsentwicklung und -größe im Nördlinger Ries auf.

INTRODUCTION

The Nördlinger Ries is an exceptional prehistoric settlement area that has attracted attention far beyond the borders of southern Germany, due especially to well-known excavations by Gerhard Bersu at the site of Goldberg in the 1910/20s. Recent research over the last 30 years has revealed a continuous development of settlement in the vicinity of Goldberg and nearby Ipf on the western edge of the Ries during the Bronze and Iron Age. The fortifications at Ipf were greatly expanded

during the period of the Urnfield Culture, and concentration processes laid the foundations for the rise of Ipf as an early Celtic princely seat (*Fürstensitz*) during the Hallstatt and Early Latène periods. After the end of the settlement at Ipf, activity shifted to the foot of the mountain in the Eger valley, where rural settlements and a *Viereckschanze* were built across several hectares from the Early to the Late Latène period.

Together with the results of archaeobotanical investigations, a settlement dynamic can be reconstructed, characterised by several changes and, for the first time in an Iron Age settlement area, showing a continuous development from the Late Bronze Age until the end of the *Viereckschanzen* in the 1st century BCE.

AIM AND BASIC PRINCIPLES OF THE RESEARCH

The state of research on population development and numbers is advanced in certain cultural areas, the level of observation ranging from individual archaeological sites to larger regions. Studies usually focus on data from cemeteries or settlements. In the present study of the Nördlinger Ries, we confine ourselves to settlement data. Selected important studies on population reconstructions based on settlements are presented in the following. A detailed account of the history of archaeological demographic research is given by Frank Nikulka (2016).

In the Middle East, Tony Wilkinson (1999) developed a methodology for regions with systematic surveys. He used the distribution of finds to infer the former settlement area, and calculated the original population size from estimates of population density; his figures of 100–200 people per km² are obviously not comparable with prehistoric ratios in central Europe. It should also be noted that a decrease in the number of settlements may imply a decrease in population, but could also be caused by aggregation processes.

As part of two major research projects, Johannes Müller has developed new models for the population sizes of individual settlements and settlement areas. For the Late Neolithic Butmir group in Bosnia, between 5300 and 4800 BCE, the calculations yielded about 2.2 inhabitants per km² for the Visoko Basin. For the well-researched settlement of Okolište, the latest phase of the Butmir group in the period around 4900/4800 BCE, about 200 contemporaneous houses with about 1000 inhabitants (at 5 p/house) could be identified. For the Butmir group as a whole, 7000 houses with 35,000 inhabitants are estimated. According to the model, 105 km² of arable land and 3500 km² of grazing land formed the basis of the diet (Müller *et al.* 2013).

These dimensions are far exceeded by the mega-settlements of the Cucuteni-Tripolje culture of 4800–3000 BCE in the northern Pontic region between the Carpathian Mountains of Romania, Moldavia and

This brief sketch of the archaeological development of the Bronze-Iron Age sequence raises the question of population development and size for the Nördlinger Ries. Furthermore, recent research in archaeobotany and archaeozoology provides new insights into demography.

Ukraine. At their height, around 3800 BCE, they could cover an area of up to 340 hectares and may have housed up to 20,000 people. These are the largest settlements of the entire Neolithic period and raise questions about proto-urbanisation (Müller 2016; Müller *et al.* 2016a; 2016b).¹

A clear contrast to this are the Bronze Age settlements in small Alpine settlement areas such as in Oberhalbstein (Grisons, Switzerland), on the Bartholomäberg in Montafon (Vorarlberg, Austria) or in the Mitterberg region in Pongau (Salzburg, Austria, Rageth 1997; Krause 2009). These mostly exposed, partly fortified settlements only allow for small populations of about 30–50 persons (assuming 4.5 persons per household), so that the settlement networks generally consisted of only about 120–200 people, or in the case of the Mitterberg region with valley and mining settlements up to about 500 people (Krause 2009, 69 table 2). A comparison with historical population data, e.g. in Oberhalbstein during the 19th century, shows a population 4–5 times higher (Rageth 1997). For Bartholomäberg, the *Vorarlberger Historisches Ortslexikon* provides a very good comparison for the number of farmsteads and men of military age for the 17th–19th centuries CE, from which an increasing population can be calculated from 634 to 997 persons with 4.5 persons per household (Krause 2009, table 4).

Based on the relatively good state of research on prehistoric settlement in the Nördlinger Ries, it is possible to reconstruct the population development in the Bronze and Iron Ages. Of particular importance is the question of how the population developed in the course of concentration processes and the growing importance of the Ipfc since the Bronze Age and in the Early Iron Age — from the Hallstatt to the Early Latène period. What were the consequences for the settlement and for the fortifications on the Ipfc in the Early Latène period? What data can we use to develop models and reconstruct population figures?

1 See Mega-Ideology and Rituals, Scales of Transformation – Human-Environmental Interaction in Prehistoric and Archaic Societies.

<https://www.sfb1266.uni-kiel.de/en/projects/cluster-c/d1-population-agglomerations-at-tripolye-cucuteni-mega-sites/trypillia-megasites/mega-ideology-and-rituals>; last access 9th January 2025



Fig. 1. The western Nördlinger Ries with Ipf and Goldberg in the background. Taken from the church tower 'Daniel' in Nördlingen (Photo: Barbara Voss).

Based on the number of settlements and their settlement areas (sizes), the number and size of contemporary houses, population estimates can be extrapolated and developed for different models with varying parameters (number of inhabitants per unit, family, economic unit, house unit). In contrast to the wetland settlements with their excellently preserved organic assemblages, the available sites in the Nördlinger Ries are limited to mineral soils with far fewer preserved archaeological remains. However, as the Ries has an excellent scientific base (for archaeobotanical and archaeozoological research), methodological principles, approaches and parameters for population size studies can be developed and finally combined on two independent levels.

In the Nördlinger Ries, in addition to numerous sites of all Neolithic phases, a large number of Bronze Age and Iron Age settlements, burials and cemeteries have been recorded, as well as hilltop settlements on the edge of the Ries, such as on Goldberg (Bersu 1930; Parzinger 1998) or on Ipf (Fig. 1; Krause 2015; Krause in press). On the topographically prominent mountain Ipf of the White Jurassic, concentration processes from the Late Bronze Age onwards led to the development of an Early Celtic princely seat (*Fürstensitz*) with a dense settlement on the summit plateau in the Early Iron Age, which could be reconstructed on the basis of geomagnetic survey and excavations (Fig. 2; and most recently Krause 2020).

THE CASE OF THE NÖRDLINGER RIES IN THE BRONZE AND IRON AGES

The Nördlinger Ries represents a unique ancient settlement landscape in southern Germany due to its particular history of formation as a result of an asteroid impact about 15 million years ago (Pöskes and Schieber 2009) and its recent post-glacial development. This favourable area with predominantly good soils (loess), numerous water bodies and good climatic factors has

been continuously populated since the Early Neolithic. The core area of our investigations is the Ries plain with a diameter of 21–23 km. However, we have extended the study area to include the heights of the Ries ridge, including the hilltop settlements (Fig. 3), so that the study area has a diameter of about 25–30 km and covers an area of about 490 km².



Fig. 2. Ipf. Ideal reconstruction of the Hallstatt period settlement on the 2.35 ha summit plateau after the geomagnetic measurements and excavations in 2004/2005 (© Landesamt für Denkmalpflege at Regierungspräsidium Stuttgart; authorship brainpetsMaas).

The state of archaeological research in the Ries is very good. Important basis for our investigations are the comprehensive studies for the Bronze Age (Knoll 2022), the Hallstatt period (Fries 2005) and the Latène period (Bick 2007), with catalogues and site maps as well as archaeobotanical and palaeoecological studies (Fischer *et al.* 2010; Stobbe 2014). The Ries thus provides an excellent starting point for southern Germany, offering, for the first time in the context of a regional study, the opportunity to develop figures and approximations of population sizes for the Early Iron Age. (cf. Nikulka 2016, 245).

In addition to the archaeological data, calculations of population sizes based on the agricultural potential of specific areas play an important role. Calculations were made for radii of 1.5, 3.0 and 6.0 km around Ipf (Fischer *et al.* 2010). Palynological data from the western Ries, in the immediate vicinity of Ipf (Stobbe 2014), make it possible to reconstruct the development of the landscape and the use of agricultural land and thus to reconstruct the cultural development in correlation with the archaeological phases (Fischer *et al.* 2010; Stobbe 2014; Krause *in press*).

The use of settlement sites to reconstruct population development has been critically discussed by Frank Nikulka (2016, 149–150). In addition to the need for temporal delimitation according to common parameters,

a critical examination of the data is particularly necessary. If the individuality method is used, the population figure is calculated individually for each settlement in the study area. The classification method, on the other hand, assigns all settlements to size classes on the basis of a few well-studied settlements.

The question of demography and land use can be investigated in two ways. First, the carrying capacity can be inferred by determining the agricultural potential of a landscape. This is done primarily through the interplay of the site balance (hypothetical soil quality based on the *Reichsbodenschätzung*), crop production based on the archaeobotanically documented plant species, and the yield potential of animal husbandry based on the recorded animal species. The result is the maximum number of people that can be fed in a given area. In this context also the concept of consumer sites plays an important role in the investigations, as it is necessary to examine the extent to which selected foodstuffs, such as cereals or meat from pigs and cattle, were supplied to the early Celtic princely seat on Ipf from the outside (Fischer *et al.* 2010).

On the other hand, the extent of land use to which a natural area has actually been used can be approached on the basis of palynological data, as they make it possible to quantify open land and give indications of arable farming, grazing and woodland exploitation.

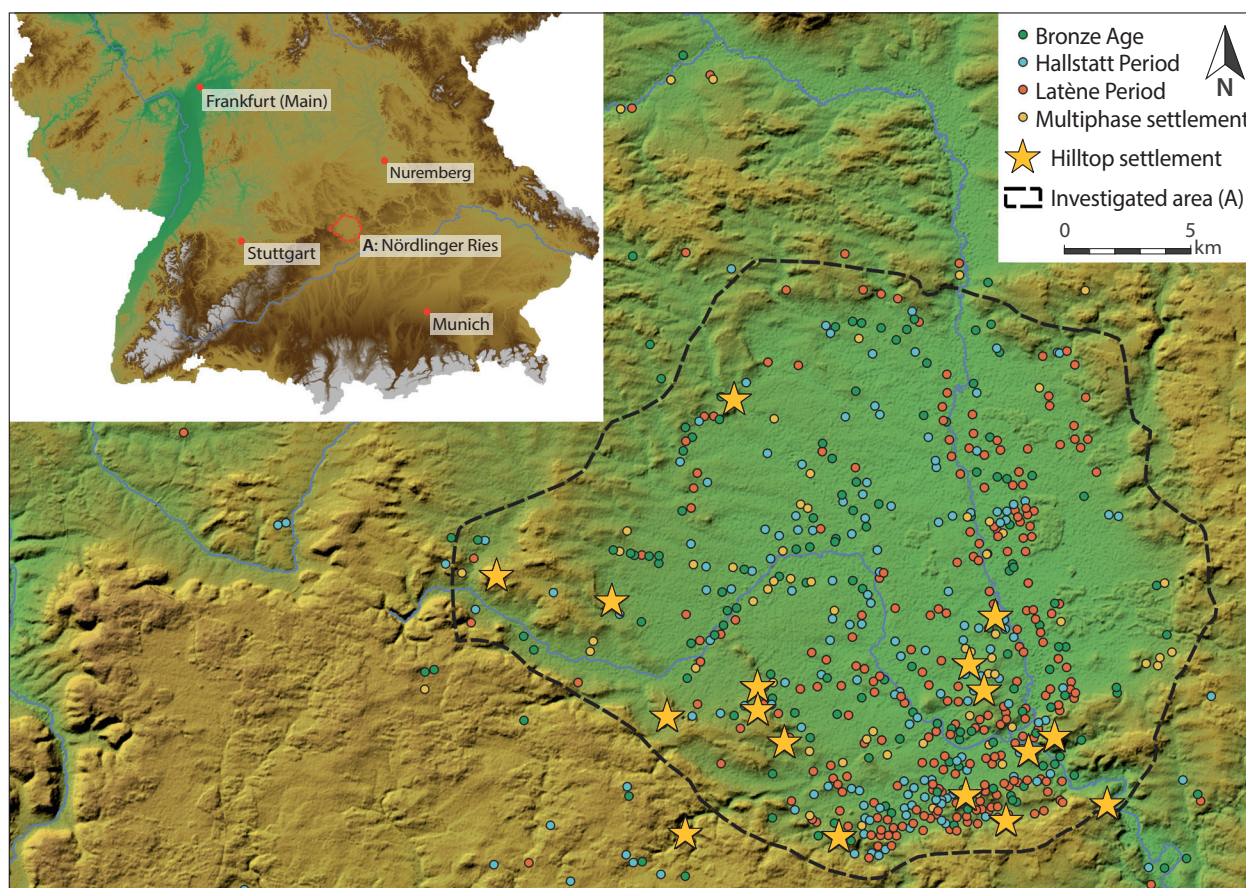


Fig. 3. Mapping of Metal Age settlements and hillfort settlements in the Nördlinger Ries. Dashed border of the working area (Map bases: GeoBasis-DE/BKG, 2024; HydroRivers, 2024, and SRTM 1 Arc-Second Global, 2018; ESRI World Hillshade, 2023; HydroRivers, 2024; map: Jonathan Schmidt).

DATABASES

Archaeology

Thanks to extensive fundamental research on the Bronze and Iron Ages in the Nördlinger Ries (Bick 2007; Fries 2005; Knoll 2022), most of the sites have been published in the respective catalogues. In addition, there are numerous sites that have recently been discovered through excavations or systematic field surveys (Krippner 1995) and have been entered into the site databases of the Landesamt für Denkmalpflege Baden-Württemberg (ADAB) and the Bayerisches Landesamt für Denkmalpflege (BayernViewer).² Furthermore the results of the route excavation for the construction of the southern ethylene pipeline were also used to estimate the number of undiscovered

settlements. The 370 km long pipeline was archaeologically investigated in a 10 m-wide strip and runs from Gosheim to Oberdorf am Ipfl through the working area in the Nördlinger Ries (Berg *et al.* 2019b). All surveyed sites have been published in a comprehensive catalogue (Berg *et al.* 2019a). Based on these investigations the proportion of undiscovered sites can be estimated by comparing them with previously known sites.

In order to reconstruct the demographic development in the Nördlinger Ries, the absolute population and the derived relative settlement and population densities are calculated for the entire study area (A), a 3 km radius in an agricultural area in the southern Ries (B) and a 3 km radius around the princely seat of Mount Ipfl in the western Ries (C in Fig. 5). In the

2 For providing the data and for their kind support, we would like to thank the Bavarian State Office for the Preservation of Monuments and the Baden-Württemberg

State Office for the Preservation of Monuments at the Regierungspräsidium Stuttgart.

Table 1. Relative and absolute chronological dating of the time sections, as well as the basis and results of the population reconstruction. A Entire Nördlinger Ries (490 km²); B Southern Nördlinger Ries (29.3 km²); C Western Nördlinger Ries (Ipf, 29.3 km²).

A	Entire Nördlinger Ries								
	Relative chronology	Absolute chronology (BCE)	Duration (years)	No. of settlements	No. of contemporary settlements	No. of central settlements	Contemporary population	Settlement density (S/km ²)	Population density (P/km ²)
Early Bronze Age (EBA)	Bz A2-B1	2200–1600	600	85	32	4	1106	0.065	2.256
Middle Bronze Age (MBA)	Bz B2-D	1600–1200	400	120	68	4	2175	0.138	4.436
Urnfield Culture (LBA)	Ha A-B	1200–800	400	228	128	10	5348	0.262	10.906
Hallstatt Period (Ha)	Ha C-D	800–450	350	306	197	14	8001	0.401	16.319
Early Latène Period (ELP)	LT A-B1	450–330	120	80	150	7	5550	0.306	11.319
Later Latène Period (LLP)	LT B2-D1	330–85	245	229	210	8	7509	0.429	15.315
B	Southern Nördlinger Ries								
	Relative chronology	Absolute chronology (BCE)	Duration (years)	No. of settlements	No. of contemporary settlements	No. of central settlements	Contemporary population	Settlement density (S/km ²)	Population density (P/km ²)
Early Bronze Age (EBA)	Bz A2-B1	2200–1600	600	17	6	2	491	0.113	8.687
Middle Bronze Age (MBA)	Bz B2-D	1600–1200	400	13	7	2	519	0.129	9.184
Urnfield Culture (LBA)	Ha A-B	1200–800	400	42	24	3	1159	0.418	20.491
Hallstatt Period (Ha)	Ha C-D	800–450	350	58	37	2	1419	0.659	25.085
Early Latène Period (ELP)	LT A-B1	450–330	120	17	32	2	1256	0.564	22.215
Later Latène Period (LLP)	LT B2-D1	330–85	245	51	47	3	1855	0.828	32.805
C	Western Nördlinger Ries – Ipf								
	Relative chronology	Absolute chronology (BCE)	Duration (years)	No. of settlements	No. of contemporary settlements	No. of central settlements	Contemporary population	Settlement density (S/km ²)	Population density (P/km ²)
Early Bronze Age (EBA)	Bz A2-B1	2200–1600	600	1	0	0	11	0.007	0.199
Middle Bronze Age (MBA)	Bz B2-D	1600–1200	400	1	1	0	17	0.010	0.298
Urnfield Culture (LBA)	Ha A-B	1200–800	400	4	2	1	218	0.040	3.846
Hallstatt Period (Ha)	Ha C-D	800–450	350	5	3	1	246	0.057	4.358
Early Latène Period (ELP)	LT A-B1	450–330	120	0	0	1	150	0	2.653
Later Latène Period (LLP)	LT B2-D1	330–85	245	2	2	0	55	0.032	0.974

absence of large cemeteries investigated with modern methods,³ the large number of settlement sites discovered during systematic field surveys forms the core of the analysis (Krippner 1995). As settlement sites can be dated primarily by pottery typology, which does

not allow a detailed chronology. Instead, the Bronze and Iron Ages were divided into six artificial time periods, in which relative chronological stages with similar pottery types were grouped together (Table 1).

CALCULATION BASES AND PARAMETERS

Archaeology

A slightly modified version of Frank Nikulka's classification method is used to calculate settlement density (Nikulka 2016, 150). Settlements are usually divided

into size classes, the population of which is determined on the basis of (largely) fully investigated settlements. As it is not always possible to determine the exact extent and boundaries of archaeological sites, in this study lowland settlements are divided into settlement units of

3 An exception is the large urnfield cemetery of the Later Urnfield Culture and Hallstatt period at Trochtelfingen,

Bopfingen, see Jana Fries (2005).



Fig. 4. Goldberg, Riesbürg-Goldburghausen. Plan of the Hallstatt period settlement after Bersu 1930, edited by Parzinger 1998 with the reconstruction of nine farmsteads in grey (after Fries 2005, 62 fig. 30).

two to three farmsteads and an assumed area of one hectare.⁴ The second category comprises central sites — fortified hilltop settlements and rectangular ditched enclosures (*Viereckschanzen*) — for which a population of around 150 inhabitants is postulated, analogous to reconstruction of the Goldberg (Fig. 4).⁵ The duration of individual settlement phases, which in most cases can only be estimated, must also be taken into account. For a few well-studied settlements, it is possible to reconstruct the duration of occupation on the basis of typochronological data. For example, the Hallstatt period settlement at the Goldberg (Ha C2/D1–Ha D2) and the Early Latène period settlement at Bopfingen-Flochberg (LT A2–LT B) can each be dated to around 100 years.

CALCULATION

Archaeology

Assuming a settlement period of about 100 years and about 30 people per settlement unit (2–3 farmsteads)

Archaeobotany and Archaeozoology

To calculate crop production, the soil conditions within 1.5, 3.0 and 6.0 km radius of Ipf were analysed on the basis of the *Reichsbodenschätzung*, and areas with a yield index of 40 and above classified as potential arable land. Areas with a yield index of less than 40, slopes of more than 10° degree, floodplains and bogs were classified as potential pasture land (Fischer *et al.* 2010). Two pollen diagrams from the immediate vicinity of the Ipf in the Sechta lowlands in the north and the Eger valley near Trochtelfingen in the south were available to quantify land use (Fig. 6; Fischer *et al.* 2010; Stobbe 2014).

in the lowlands, the total population of the Nördlinger Ries can be determined from the number of sites with an increase in the central settlements, assuming 150 inhabitants for each of the time slices. This

⁴ See Tony Wilkinson (1999, 48) on the methodology.

⁵ While Hermann Parzinger (1998) estimated the population at 90 people based on nine farmstead units with ten

inhabitants each, Frank Nikulka (2016, 247) postulated a population of 150–200 people with conclusive arguments.

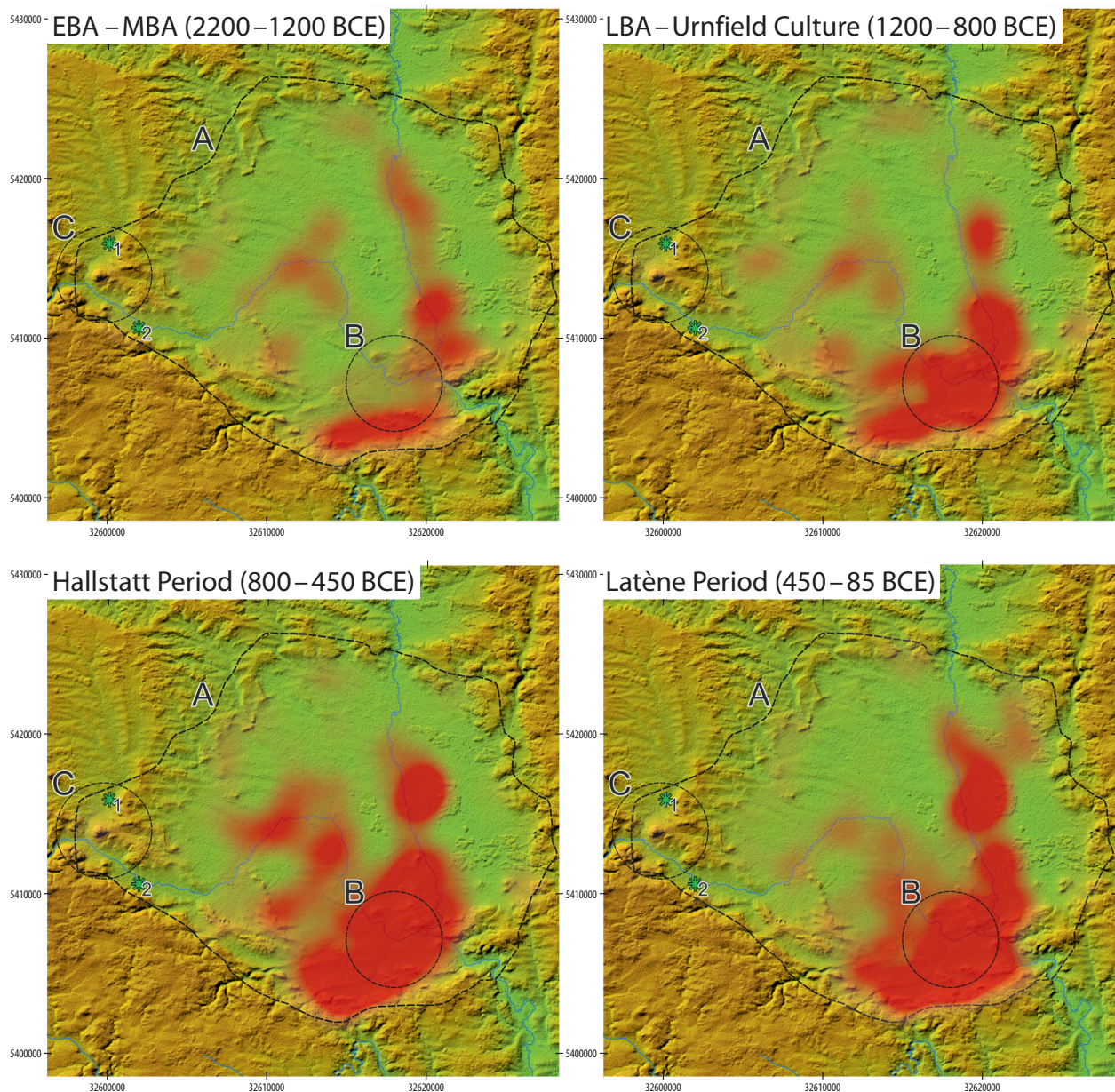
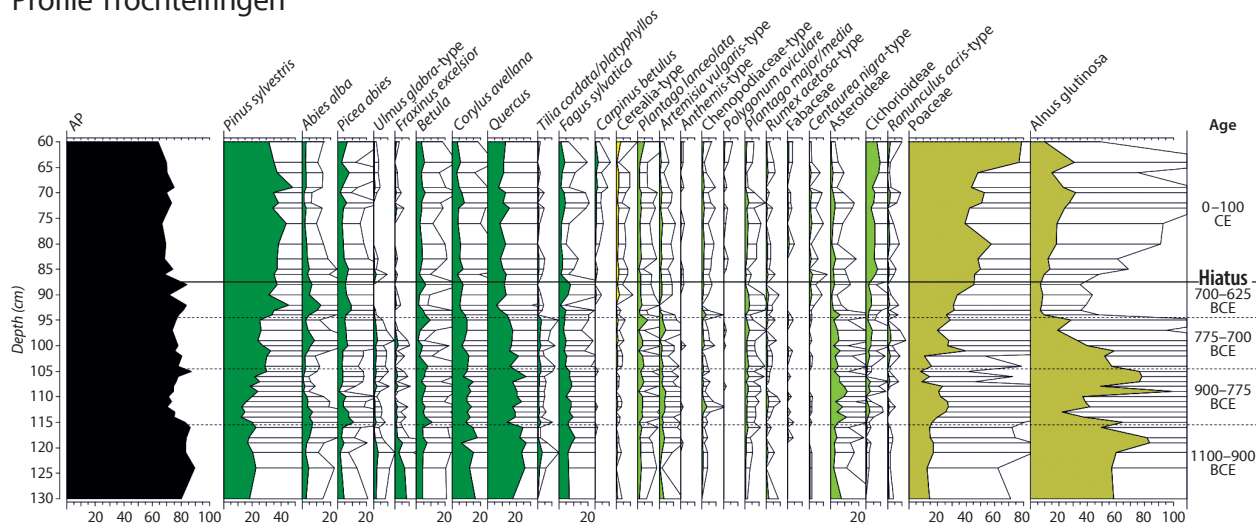


Fig. 5. Nördlinger Ries. Settlement density during the Early to Middle Bronze Age (EBA-MBA; 2200–1200 BC), the Late Bronze Age Urnfield Culture (LBA; 1200–800 BC), the Hallstatt Period (800–450 BC) and the Latène Period (450–85 BC). A Entire Nördlinger Ries; B Southern Nördlinger Ries; C Western Nördlinger Ries (Ipf). 1 Weidelwiesen pollen diagram; 2 Trochtelfingen pollen diagram (Map basis: SRTM 1 Arc-Second Global (2018); ESRI World Hillshade (2023); HydroRivers (2024); map: Jonathan Schmidt).

number can then be multiplied by the factor of unrecorded settlements. There are 41 sites in the study area that were archaeologically investigated prior to the construction of the Ethylene Pipeline South (Berg *et al.* 2019a, Cat.No. 52–93). Nineteen of the sites (50%) were pre-Roman Bronze/Iron Age settlement sites, of which almost half ($n=9$) only became known through the excavation of the pipeline route. In addition, eleven (25%) other settlement sites were discovered that are of indeterminate pre-Roman date and are difficult to

categorise methodologically. As some of these sites may be exclusively Neolithic and the low number of finds may correlate with a short period of use, these sites are only considered with a conservative factor of 1.25. Therefore, for each known settlement site, one previously undiscovered settlement of the date and one undiscovered settlement of unknown date can therefore be assumed, and the calculated number of settlements must be multiplied by a factor of 2.25.

Profile Trochtelfingen



Profile Weidelwiesen

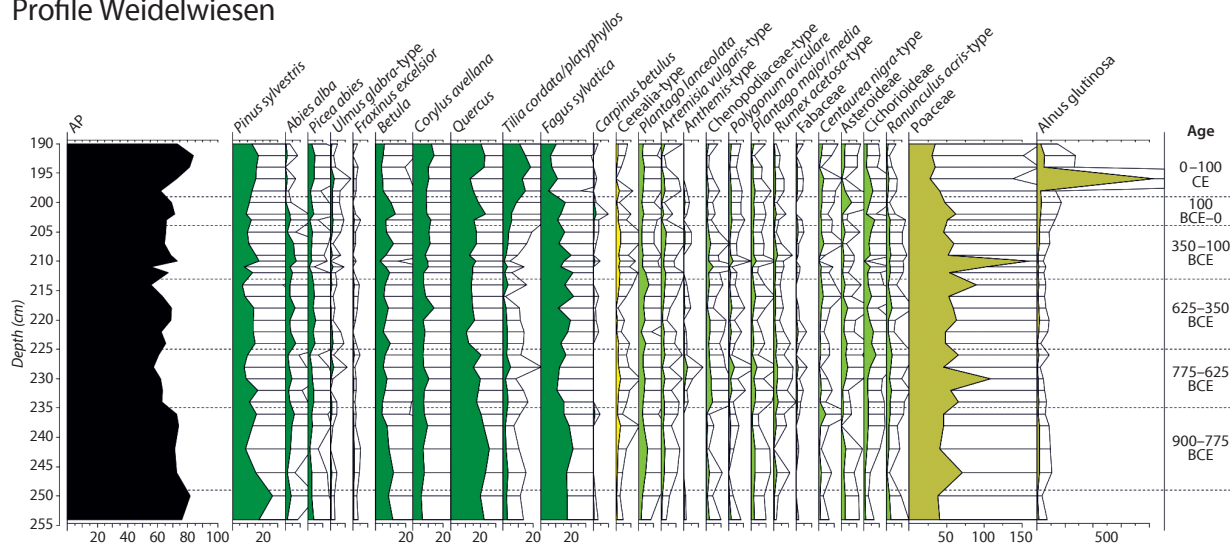


Fig. 6. Pollen diagram Trochtelfingen, approximately 4 km south of the IpF in the Eger floodplain, and pollen diagram Weidelwiesen, approximately 2 km north of the IpF in the Sechta floodplain.

In addition to the absolute population size, the relative settlement and population density can be calculated for the entire study area of about 490 km² (Table 1, A). These calculations were also carried out for the 3 km radius in a particularly densely populated area in the southern Ries and for the 3 km radius around IpF (Table 1, B–C).

Archaeobotany and Archaeozoology

To calculate the maximum population that could be fed in a given area, a yield of 1000 kg per hectare of arable land was assumed for the Iron Age (Fischer *et al.*

2010). In this case, a crop/field ratio of 2:1 was used. A requirement of 2000 kcal per person per day was used for calculation. It was assumed that 76–98 % of the calories came from plant foods, with the remainder coming from meat. Calculations were made for a radius of 1.5, 3.0 and 6.0 km around the IpF. In the pollen profiles (Fig. 6), the ratio of non-arboreal to arboreal pollen was used to estimate deforestation and the presence of pollen types associated with arable farming (especially *Cerealia*-type) and grazing (especially *Plantago lanceolata* and *Artemisia*) were used as indicators of the type and degree of use (for more details, see Fischer *et al.* 2010; Stobbe 2014).

Results

The results of the calculations are shown in figure 7. For the whole of the Nördlinger Ries, estimated population during the Early Bronze Age is low at just over two persons/p/km² (p/km²; a total of about 1100 persons). Hardly any settlement activity can be detected in the vicinity of the Ipfl, although traces of Early Bronze Age occupation have been found on the mountain (Knoll 2020; Krause in press). Intensive use at this time is only found in the favourable agricultural areas of the southern Ries. Here, the population density remained constant during the Middle Bronze Age, while an increase to just under 4.5 p/km² in the entire Ries indicates the development of further settlement areas and landscapes. These values agree quite well with population density which were estimated for Central Europe and southern Scandinavia, which are around 1.5 p/km² for the Early Bronze Age and around 2.5 p/km² around 1500 BCE (Müller 2016). Densities of around 15 p/km² were calculated for core areas, which are significantly higher than the core area investigated in the Ries (8.7–9.2 p/km²).

During the Late Bronze Age Urnfield Culture, there is a strong increase in population, especially in areas which are cultivated even more intensively for agriculture. The population density of 1–5 pers./km² estimated for the Urnfield Culture (Nikulka 2016, 233–235) is clearly exceeded with a population density of almost eleven pers./km² (20.5 pers./km² in the southern Ries), as according to Frank Nikulka values above ten persons/p/km² are only possible in special settlement areas.

The beginning of the occupation at Ipfl and its immediate surroundings can also be dated to the Late Bronze Age Urnfield Culture; the intensity of occupation is already just below the peak of the Hallstatt period. With a calculated maximum number of about 250 people, the settlement around the Ipfl remains far below the 5000 inhabitants postulated for the Heuneburg (Kurz 2009; Schumann 2019). Meanwhile, densities of up to 25 pers./km² were reached in the densely populated southern Ries during the Hallstatt period (1420 people on 28.3 km²), while calculations for the Ries as a whole show a lower density of 16 pers./km² and a total of 8000 people.

An increase in population postulated for the Early Latène period, as in other regions (Nikulka 2016, 253),

is not archaeologically evident in the Ries; the population actually decreased overall, but much less so in the southern Ries area. At Ipfl, however, there is a clear decline that continues into the later Latène period. However, this trend does not affect the whole of the Nördlinger Ries, as the total population increases again in the Late Latène period and is only just below the population figures of the Hallstatt period. In the southern part of the Ries, the population even increased rapidly to a peak of 33 persons/p/km² (1850 persons on 28.3 km²).

Archaeobotany and archaeozoology

In the calculations, the number of people who could potentially be fed is largely determined by the amount of crops grown, which results in large differences between areas with very high soil quality, such as in the southern Ries, and those with lower soil quality, such as in the western Ries around the Ipfl. It has been calculated that in the Iron Age a maximum of 300 people could be fed within a 1.5 km radius of the Ipfl, 1800 within a 3 km radius and 9000 within a 6 km radius (Fischer *et al.* 2010). Unfortunately, no such calculations are available for the rest of the Ries region. In areas with a significantly higher agricultural potential, such as around Hochdorf (Fischer *et al.* 2010), the maximum number of people to be fed within a 1.5 km radius is around 1,600, in a 3 km radius around 4,600 and in a 6 km radius around 16,000 using the same calculation method. These values can certainly be used as a comparison for the southern Ries.

Indicators of agriculture and animal husbandry are consistently detected in both pollen profiles, albeit at different levels (see Fig. 6). Between 1100 and 900 BCE, the proportion of non-arboreal pollen (NAP) is low, not reaching 20%. From 900 BCE (Late Urnfield Culture) onwards, the proportion of non-arboreal pollen reaches over 20% and rises to 40% in the Early Iron Age (Fig. 6 profile Weidelwiesen). Based on the comparison with the proportion of arboreal pollen in modern surface samples, it can be assumed that the proportion of forest in the Ries plain in the Iron Age was no higher than today or in Roman times, and only slightly higher than in the Middle Ages (Fischer *et al.* 2010).

DISCUSSION

The Nördlinger Ries, as a special ancient settlement landscape in southern Germany, offers a good basis for the investigation of population development, population size and intensity of use due to its favourable settlement

parameters and good state of research. By combining and interpreting the different palaeoenvironmental and archaeological parameters, a population model for the Metal Age could be developed for the Ries.

Calculations of maximum crop yields and livestock numbers based on soil quality showed that in the Iron Age the area around Ipf could have supported about 80 people per km². In areas with higher soil quality, such as the southern Ries, 150 people per km² would have been possible (Fischer *et al.* 2010). This roughly corresponds to the figures known from the *Oberamtsschreibungen* for the Kingdom of Württemberg from the first half of the 19th century CE. However, this presumably meant that the agricultural production/population system had reached its limits under the given agricultural production structures and conditions at the beginning of the 19th century CE (cf. in Fischer *et al.* 2010). If we now compare the population figures with the population densities calculated on the basis of archaeological data for the Bronze and Iron Ages, they are much lower. It has been estimated that the population density in the Bronze Age was between 10 and 20 inhabitants per km², while in the Iron Age it was between 20 and 33 inhabitants per km² (see Fig. 7). It is therefore unlikely that the proportion of land available for agriculture was at any time a limiting factor, even in densely populated regions such as the southern part of the Ries plain (see Fig. 5).⁶ The data on vegetation history also show different intensities of use in the diachronic sequence according to changing population densities (see Fig. 6 and Stobbe 2014). The increase of Late Bronze Age Urnfield settlements in the Ries plain is clearly visible in profile Trochtelfingen (Fig. 6), especially from 900 BCE onwards.

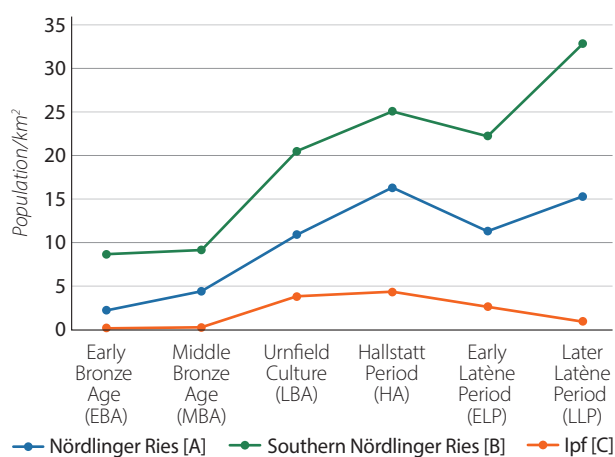


Fig. 7. Population dynamics during the Metal Age in the Nördlinger Ries, Southern Germany (P/km²). A Entire Nördlinger Ries (490 km²); B Southern Nördlinger Ries, 29.3 km²; C Western Nördlinger Ries, Ipf, 29.3 km² (Graphic: Jonathan Schmidt).

This is all the more surprising as the density of sites in the vicinity of the pollen profile is very low (see Fig. 5). Among the non-arboreal pollen, *Plantago lanceolata*, *Plantago major* and *Artemisia* species, which are associated with animal husbandry, increase in abundance, while the cereal values, which are indicative of agriculture, hardly increase at all. It can be assumed that animal husbandry, in particular in the vicinity of the archaeobotanical archives, increased, which seems plausible in view of the prevailing soils. The local conditions were particularly favourable for pig rearing in the oak-rich alluvial forests and the wet alluvial forests.

In the Early Iron Age a further increase in population has been reconstructed for the Hallstatt period (phases Ha C and D, Fig. 7). The increased land use is also evident in the pollen diagrams (see Fig. 6; Stobbe 2014). Non-arboreal pollen values increase significantly and especially the decreasing beech values indicate woodland clearance. In the alluvial areas, alluvial and swamp forests were cleared in favour of wet meadows (profile Trochtelfingen). Erosion in the Trochtelfingen peat profile and increased alluvial deposits in the Sechta alluvial plain can be observed, as the intensive use of the landscape led to soil erosion. The remaining forest consisted mainly of oak woodland. Grasslands were widespread. The archaeozoological evidence also suggests a less forested landscape, as there is now evidence for significantly more hare bones, an animal adapted to open land.

The archaeobotanical evidence from the Late Hallstatt period shows a clear distinction between rural and central sites. In the rural settlements, the “producer sites”, there is evidence of a high diversity of cultivated plants, which testifies to self-sufficiency in the countryside and differs only slightly from the rural sites of the Urnfield and Latène periods. In the central settlements, considered as “consumer sites”, barley predominates, followed by spelt. Cultivation in the central sites probably did not differ from that in the rural settlements, since the large population and the division of labour meant that some of the plant food had to be imported. The import, however, was essentially limited to the two main cereals, spelt and barley. Pulses, which increased significantly in the Hallstatt period compared to the Late Bronze Age Urnfield period, only played an important role in rural settlements.

In central settlements, the protein and fat requirements were probably met mainly by animal-based food. Livestock farming requires more land than

6 Overall, the animal populations found for the Iron Age are very low and could have been higher, so that the proportion of animal husbandry would have to be classified as more significant (Fischer *et al.* 2010). However, as

less energy per unit area can be obtained from meat than from cereals, this would lead to a reduction in the number of people per km² that could be fed, which would certainly be closer to the calculated population model.

arable farming, which could explain the high proportion of non-arboreal pollen in the pollen diagrams. The strontium isotope signatures of the animals from the *Viereckschanze* at Ipf also show that, apart from a few animals that may have been imported from outside, the animals consumed were predominantly local and not from the nearby pastures of the Swabian Alb (Stephan *et al.* 2017). Pigs were the main source of meat, but sheep and goats were also used. People could afford to eat calves as well as pigs. Sheep were also important for wool production (Fischer *et al.* 2010).

A decline in settlement activities in the Early Latène period is not apparent in the pollen diagrams (see Fig. 6 profile Weidelwiesen, Hiatus in profile Trochtelfingen), which contradicts the archaeological data on population development. It is possible that sites of this date are often assigned to the Hallstatt or later Latène period, or are less frequently taphonomically visible, and that settlements were used by larger groups than in previous periods.

A further expansion of cultivated areas is palynologically evident from 350 BCE onwards (LT B2). This correlates well with the distinct increase in population reconstructed in the southern Ries of over 35 inhabitants per km² (Table 1; Fig. 6). Although the evidence for settlements around the Ipf and in the vicinity of the pollen profiles is decreasing, there is evidence for an increased use of the dry, steep slopes for grazing, especially for sheep, and an intensification of arable farming (Stobbe 2014). This suggests a shortening of the fallow period, which can also be inferred from the arable weeds found in the settlements. At the same time, there is a decrease in legumes.

For the end of the Late Latène Period (LT D2) there are no more usable data from the study area; according to Bick there is no more evidence for settlements in the Ries in the 1st century BCE (Bick 2007, 243). It is likely that all of the *Viereckschanzen* at Ipf came to an end during this period (Krause in press). The palynological evidence shows a reduction in the area used for

agriculture from around 100 BCE, but no complete cessation of agricultural activity.

Following the decline of the larger settlements, it is probable that further changes occurred in the period preceding the Roman occupation. These changes may have resulted in a reduction in the number of settlements and their population, as well as a shift in the way settlements were organised. Rupert Gebhard suggests that the end of the oppidum of Manching marked the conclusion of a specific economic system, leading to a gradual dissolution of the oppidum settlement (Gebhard 1991, 104). In any case, there are probably several reasons why the latest settlement activities are not yet recognizable in the archaeological finds and represent a particular challenge for future research, especially as the archaeobotanical results indicate that people also lived and farmed in the Ries during the Late Latène period in the 1st millennium BCE.

If one considers the effects of anthropogenic activity since the Late Urnfield Culture at the latest in the palynological analyses and recalls that the locations of the two pollen diagrams on the western edge of the Nördlinger Ries (Stobbe 2014) are not in areas of high settlement density (see Fig. 5), the clear anthropogenic impact is surprising. Even in these peripheral locations, a high level of anthropogenic impact is indicated since the Late Bronze Age Urnfield Culture, which already in the Late Hallstatt period covered all parts of the landscape from the wet meadows to the dry slopes. In the much more densely populated southern Ries, from which unfortunately no palynological studies have been carried out, it must be assumed that the area was intensively used, especially for arable farming, due to the good soils. On the other hand, extensive grazing, as can be assumed for the area around Ipf, also leads to a strong opening of the landscape. However, given the calculated population densities, the availability of agricultural land is unlikely to have been a limiting factor for population growth at any time.

CONCLUSION

By combining population models based on archaeological settlement data divided into several time slices and comparing them with results from archaeobotanical and archaeozoological studies, it was possible to shed light on population developments and land use throughout the Bronze and Iron Age in a specific prehistoric settlement area in southern Germany. In the Nördlinger Ries a population increase from about 1100 persons (2.3 pers./km²) in the Early Bronze Age to about 5350 persons (11 pers./km²) could be traced (Fig. 7). At the height of the Iron Age settlement,

population densities of 8000 (16 pers./km², Hallstatt period) and 7500 (15 pers./km², Latène period) can be assumed, and in agriculturally favourable areas of the southern Ries even 25 and 33 pers./km² respectively.

These results are well below the theoretical carrying capacity of up to 150 pers./km² in the southern Ries. This order of magnitude, which according to the *Oberamtsbeschreibungen* of the Kingdom of Württemberg roughly corresponds to the population figures of the 19th century CE, underlines the favourable basis for agriculture and food production. The natural conditions

for higher population figures were probably always present and were not a limiting factor for prehistoric occupation in the southern German settlement area of the Nördlinger Ries. Interestingly, the current population of the Nördlinger Ries remains below these possible maximum numbers. For example, the Bavarian

district of Donau-Ries, which includes large parts of the Ries that are still used for agriculture, and extends south to the Danube with the two towns of Nördlingen and Donauwörth, has a population density of 108 people/km².⁷

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⁷ Bavarian Statistical Office, Fürth 2024: Update of the population status, “Inhabitants per square kilometer: Municipalities, reference data (from 1980)” (06. April 2024).

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Die Megastruktur von Stăuceni-„Holm“, Kreis Botoșani, Rumänien und die Debatte um die Organisation von Cucuteni-Trypillia-Siedlungen

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KEYWORDS: megastructures, Cucuteni-Trypillia, excavation, Romania

Zusammenfassung

In den Jahren 2021 bis 2023 wurde die Cucuteni A-Siedlung von Stăuceni-„Holm“, Kreis Botoșani im Nordosten Rumäniens geophysikalisch prospektiert. Die Siedlung in Spornlage war nach Süden durch mehrere Graben- und Palisadenanlagen abgeriegelt. Im Bereich der Gräben befindet sich eine vor allem aufgrund ihrer Größe und gut sichtbaren Position in der Nähe des Zugangsbereichs der Siedlung sogenannte

Megastruktur. Dieses wurde im Jahre 2023 mit Hilfe von zwei Grabungsschnitten zum Teil ausgegraben. Die Beobachtungen, insbesondere zur Boden- und Wandgestaltung liefern wertvolle Informationen zur Diskussion um die Funktion dieser Sonderbauten, von denen bisher erst vier weitere durch Ausgrabungen näher untersucht wurden.

Abstract

Between 2021 and 2023, the Cucuteni A settlement of Stăuceni-„Holm“, Botoșani District in Northeastern Romania, was geophysically surveyed. The settlement is located on a flat promontory with several ditches and palisades delimiting the access from the southern end. Here, a so-called megastructure was partly excavated in 2023. The dwelling is bigger than the other houses

at the site and located at a very prominent position close to the probable access of the settlement. The observations, particularly concerning the floor and wall constructions, provide valuable information for a discussion on the function of such special structures, of which only four have been examined in more detail through excavations thus far.

EINLEITUNG

Seit der Erfassung der außerordentlichen Größe der Cucuteni-Trypillia mega-sites in der Ukraine mit Hilfe von Luftbildern und geophysikalischen Prospektionen (z. B. Shmaglij *et al.* 1973; Shishkin 1973; Dudkin 1978; Chapman *et al.* 2014b; Rassmann *et al.* 2014; Videiko und Rassmann 2016 mit einer Zusammenfassung der bisherigen Forschungsgeschichte) steht die Frage im Raum, wie solche Siedlungen mit bis zu 3000 Gebäuden und nach Schätzungen 5.000–15.000 gleichzeitig lebender Menschen (Ohlrau 2015, 74 Abb. 54; Ohlrau 2022, 88–91) funktioniert haben können. Diese Frage stellt sich insbesondere vor dem Hintergrund, dass in den geophysikalisch erfassten Grundrissen bislang keine Sonderbauten, Marktplätze, Kultstätten oder

ähnliches zu erkennen sind. Auch Schrift oder Gegenstände, die zur Organisation und Verwaltung des Zusammenlebens einer größeren Menschenmenge und ihres Besitzes sowie ihrer Güter beitragen könnten, sind nicht überliefert, sollen nicht die Funde, die als Token gedeutet werden in diese Richtung interpretiert werden. Eine wie auch immer geartete Organisationsstruktur erscheint aber für eine solche Personenzahl zwingend erforderlich. Sie betrifft die Siedlung selbst, die Ökonomie aber auch das soziale Zusammenleben der Kommune. Auf den ersten Blick sehen die Grundrisse der *mega-sites* geplant aus, mit ordentlich aufgereihten Häuserzeilen und gelegentlich um kleinere freie Höfe gruppierte Häuserzeilen bei ansonsten fast völlig

gleichartiger Bauweise. Es ist wohl aufgrund dieser Gleichartigkeit, dass eine dahinterstehende egalitäre Gesellschaftsstruktur vermutet wird, ohne hierarchische Strukturierung und ohne Herrscher (z. B. Monah 2003; Wengrow 2015, 5; Hofmann *et al.* 2016, 157; Müller 2016a; Müller *et al.* 2018; Hofmann *et al.* 2024a; Graeber und Wengrow 2024, 316–325).

Die Interpretation als weitgehend egalitäre Gesellschaften ist bis heute nach wie vor vorherrschend, auch nachdem in den letzten Jahren — vor allem dank der verbesserten Messtechnik — im Bereich der Geomagnetik sehr detaillierte Siedlungspläne erzeugt werden konnten. Auch konnte mit aufwendigen Datierungsprogrammen zumindest für einige Plätze eine deutlich längere Besiedlungsdauer wahrscheinlich gemacht werden. Dies gilt z. B. für Maidanetske mit mehreren Siedlungsphasen in insgesamt rund 350 Jahren zwischen 3990 und 3640 cal BC (1 σ) (Ohlrau 2020, 226).

Es muss hinterfragt werden, ob sich vertikale und/oder horizontale gesellschaftliche Stratifizierungen unbedingt im Grundriss von Siedlungsplänen widerspiegeln müssen. An dieser Stelle kann jedoch keine tiefgreifende ethnographisch-historische Vergleichsstudie vorgelegt werden. Stattdessen sollen die in den modernen geomagnetischen Plänen sichtbaren Differenzen zwischen den Baustrukturen herangezogen werden, um das Phänomen bestimmter Sonderbauten, der Megastrukturen und ihre Interpretation zu beleuchten. Bisher wurden die Megastrukturen als kommunale Einrichtungen zur Entscheidungsfindung oder

für andere Zwecke interpretiert (u. a. Chapman *et al.* 2014b; Hofmann *et al.* 2016, 174; Müller *et al.* 2016a; 2016b; Hofmann *et al.* 2019).

Es ist das Verdienst des Jubilars und seines Teams, dass mit seinen Forschungen in der Ukraine, Moldawien und Rumänien zum Verständnis des Cucuteni-Trypillia-Phänomens an so berühmten Fundstellen wie Maidanetske oder Stolniceni massive Fortschritte erzielt worden sind (z. B. Müller *et al.* 2016a; 2016b; Müller *et al.* 2017; Hofmann *et al.* 2024b). Als roter Faden durchzieht außerdem die Sozialarchäologie mit Aspekten zu Macht und sozialer Ungleichheit Johannes Müllers Arbeit. Daher hoffen wir, mit unserem Artikel zur Megastruktur von Stăuceni einen kleinen Beitrag zur Diskussion über die soziale und politische Organisation der *mega-sites* sowie über die Entstehung und Ablehnung hierarchischer Systeme leisten zu können.

Im Sommer 2023 fand eine vierwöchige Lehrgrabung für die Studierenden des Instituts für Ur- und Frühgeschichte der Friedrich-Alexander-Universität Erlangen-Nürnberg zusammen mit dem Kreismuseum Botoșani in Stăuceni-„Holm“, Jud. Botoșani, statt. Die ersten und noch vorläufigen Ergebnisse sollen nun in dem Band zum 65. Geburtstag Johannes Müllers veröffentlicht werden.

Unsere Forschungsfrage betrifft die *Art der Architektur dieser Megastrukturen, ihre Datierung* und den Vergleich mit den anderen ausgegrabenen Bauten sowie *ihre Funktion* innerhalb der Siedlung und der diese Bauten nutzenden Gesellschaften.

MEGASTRUKTUREN

Am Fundplatz Stăuceni-„Holm“ im Kreis Botoșani in der Region Moldau im Nordosten Rumäniens erfassen geomagnetische Prospektionen eine Cucuteni-Siedlung im Grundriss (Abb. 1–2). Am südlichen Rand der Spornsiedlung befindet sich ein vergleichsweise außergewöhnlich großes Haus, welches unserer Meinung nach als „Megastruktur“ gemäß der Definition von Михайл Видейко *et al.* (2013, 97) und John Chapman *et al.* (2014a, 135) bezeichnet werden kann. Mikhail Videiko und John Chapman prägten erstmals den Begriff für solche Großbauten anhand der geomagnetischen Messbilder vom Fundplatz Nebelivka.

Robert Hofmann *et al.* (2019) werten in ihrem Artikel 140 aus der Geomagnetik bekannte Megastrukturen von 19 Fundplätzen hauptsächlich aus der Ukraine und der Republik Moldawien aus. In ihrem Beitrag fassen sie den Forschungsstand zusammen und analysieren Gemeinsamkeiten und Unterschiede. Als Definition werden inzwischen folgende Aspekte herangezogen (nach Hofmann *et al.* 2019, 5; auch Ohlrau und Rud 2019, 88; Müller *et al.* 2018, 249 oder Rud *et al.* 2024):

Notwendige Aspekte:

- Rechteckige Konstruktionen, die häufig größer sind als reguläre Häuser;
- hauptsächlich in nicht-bebauten Arealen, Ring-Korridoren oder Plazas (unbebaute rechteckige Höfe, die von Reihen paralleler Häuserzeilen gebildet werden, die pro Seite um 90° gedrehte Orientierungen aufweisen) liegend;
- Standort ist sehr gut sichtbar.

Ergänzende Aspekte:

- Unterschiede in der Bauweise im Vergleich zu Wohnhäusern.
- Außerordentlich große Dimensionen.

René Ohlrau unterscheidet zusätzlich zwischen

- a) Megastrukturen, die bis zu 70 m lang und bis zu 24 m breit sind, die nur isoliert auftreten und
- b) den, in mehr oder weniger regelmäßigen Abständen anzutreffenden, in Ring-Straßen oder Zuwegungen auftretenden Megastrukturen (Ohlrau 2020, 285).

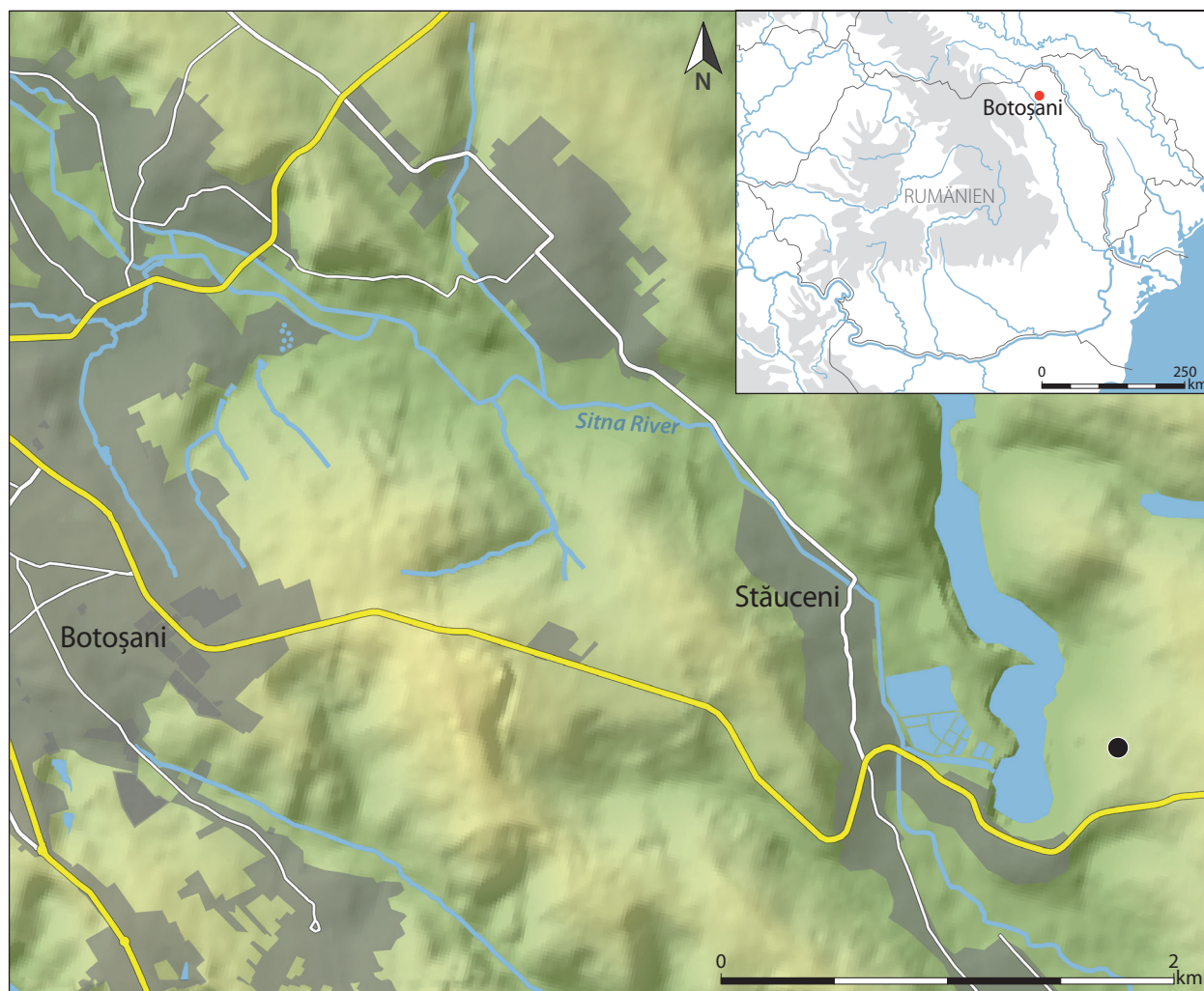


Abb. 1. Stăuceni-„Holm“. Lage des Fundplatzes (schwarzer Punkt) im Tal der Sitna, östlich von Botoșani, Rumänien (Grafik: Carsten Mischka).

Für die Autoren:innen dieses Beitrags ist für die Ansprache als Megastruktur insbesondere der relative Größenunterschied zu den sonstigen Bauten der Siedlung entscheidend für die Bewertung. Der relevante Befund in Stăuceni-„Holm“ bildet hier mit rund 350 m² im Vergleich zu den sonstigen Bauten mit Flächen von

ca. 70–120 m² (Interquartile, Median: 91 m²) einen signifikanten Ausreißer. Auch die gut sichtbare Position, direkt hinter dem Graben, mutmaßlich in der Nähe des Zugangs sprechen für die Interpretation als Megastruktur.

FORSCHUNGSSTAND ZU DEN MEGASTRUKTUREN

Die relevanten Ergebnisse aus dem Artikel von Robert Hofmann *et al.* (2019) lauten:

- Megastrukturen treten in den ringförmigen Siedlungen der Trypillia-Kultur an sechs verschiedenen Positionen auf: P1 auf einem zentralen Platz nahe des angenommenen Haupteingangs in die Siedlung an der östlichen Seite; P2 auf sekundären Plätzen, P3 innerhalb des Ring-Korridors; P4 entlang radialer Straßen in der Siedlung in der Nähe

der äußersten Häuserreihen oder P6 entlang dieser Durchgänge aber in mehr zentrumsnaher Lage und P5 außerhalb der äußersten Häuserzeile und quer zu dieser orientiert (Hofmann *et al.* 2019, 36–38 Abb. 19).

- Basierend auf den Dimensionen, internen Unterteilungen und internen Befunden ist es möglich eine typologische Klassifikation der Bauten vorzunehmen (*ibid.*, 37–40, insbes. Abb. 22).



Abb. 2. Stăuceni-„Holm“. Magnetogramm mit Umzeichnung der Haus- und Grabenbefunde. Die Megastruktur befindet sich südlich des inneren Grabens (weißer Rahmen); rechts oben: Vergrößerung des Ausschnitts mit der Megastruktur, die gelben Linien markieren die Lage der Grabungsschnitte im Jahre 2023 (Grafik: Carsten Mischka).

Die Binnengliederung basiert derzeit hauptsächlich auf der Auswertung der Messwerte aus der Geomagnetik. Es lassen sich Megastrukturen, die im Innenraum starke Anomalien aufweisen von solchen unterschieden, die ganz oder zum Teil nur im Bereich der Außenwände stärkere Anomalien zeigen. Diese Beobachtungen werden als Hinweise auf überdachte und nicht-überdachte Areale interpretiert, die von Holz-Lehmwänden begrenzt sind (Gaydarska *et al.* 2019, 199; Hofmann *et al.* 2019, 37–40).

Bisher fanden nach Robert Hofmann *et al.* (2019) erst an vier Megastrukturen Ausgrabungen statt.

Der älteste Fundplatz Baia în Muchie, Kreis Suceava, Rumänien ist nach den Ausgräbern Pre-Cucuteni I zeitlich (Ursu und Țerna 2015; Hofmann *et al.* 2016, 174; Müller *et al.* 2018, 251). Leider liegt von diesem Befund bislang nur ein kurzer Bericht mit wenigen Abbildungen vor. Es handelt sich um eine normale Siedlung, keine *mega-site*. Die 220–230 m² große Megastruktur liegt im Zentrum der Siedlung. Die Außenbegrenzung des Gebäudes wird durch ein Gräbchen gebildet, in dem in regelmäßigen Abständen über 1 m tiefe Pfostengruben eingetieft sind. In dem Gebäude von Baia sind über 200 große Gefäße, darunter auch anthropomorph verzierte entdeckt worden, sowie eine größere Zahl anderer Funde.

Die zuerst ausgegrabene, mit ca. 60 x 18 m (1120 m²) besonders große Megastruktur von Nebelivka in der Ukraine wird in die Zeit zwischen 3990/3840 und 3850/3740 BCE (Trypillia BII) datiert und soll über 160 Jahre hinweg genutzt worden sein (Chapman 2014a, 2014b; Chapman *et al.* 2016; Burdo und Videiko 2016; Gaydarska *et al.* 2019, 195; nach Millard 2020, 256 bis mindestens 200 Jahre). Die Struktur besteht aus zwei Teilen mit 20–24 m und 38–40 m Länge, die anhand der Mengen und Lage des verbrannten Lehms definiert werden. Der Ostteil enthält wenig Brandlehm und auch sonst kaum Funde und keine weiteren Befunde im inneren Bereich; lediglich die Begrenzung hebt sich auf einem Streifen von 1,0–1,5 m durch höhere Lehmanteile ab. Dieser östliche Teil liegt zudem etwa 0,4 m tiefer als der Westteil (Burdo und Videiko 2016, 110–111). John Chapman *et al.* merken an: „*Excavation to a greater depth also confirmed no obvious ditch profiles*“ (Chapman *et al.* 2014a, 140).

Im Westteil konnten die Ausgräber vier stratigraphische Phasen trennen. Unter der Megastruktur wurden Gruben und Pfostengruben angetroffen. Die Megastruktur selbst wird in eine zweiphasige Bau- bzw. Nutzphase sowie eine Zerstörungs- und Verfüllungsphase unterteilt (Gaydarska *et al.* 2019, 195). Im Inneren finden sich Einbauten aus Lehm sowie vor allem sieben sogenannte Plattformen. Den publizierten

Bildern nach entsprechen sie in ihrer Oberfläche den im Cucuteni-Kontext als Feuerstellenunterbau angesprochenen Befunden. In Nebelivka sind die Flächen dieser Einbauten allerdings mit teils mehreren Quadratmetern Fläche übermäßig groß und sind außerdem teilweise verziert.

In der Struktur wurden 60 kg Gefäßscherben geborgen, die von mindestens 332 Gefäßen stammen. Vergleichsweise wenige besondere Funde wurden gemacht, darunter eine kleine Goldspirale, eine graphitierte Schale mit Verbindung zum Balkan und ein Set an Miniaturgefäßen (Chapman *et al.* 2014a, 150 Abb. 17; Gaydarska *et al.* 2020b). Auch die Menge der Funde unterscheidet sich nicht wesentlich von normalen Häusern. Nur sechs Silices, darunter eine sichere Pfeilspitze sind entdeckt worden (Gaydarska *et al.* 2020a, 194–211; Gaydarska *et al.* 2019, 107), was bei der Distanz zum nächsten Feuersteinvorkommen jedoch nicht weiter verwundert. Nicht zuletzt die Interpretation der Megastruktur von Nebelivka als überdachtes Versammlungshaus oder Tempel mit „ummauerten“ Vorhof führte zwischen den Ausgräbern zu Uneinigkeit (Chapman *et al.* 2014a mit Ausführungen zu den differierenden Interpretationen; Chapman *et al.* 2016; Burdo und Videiko 2016).

Die 170 ha große und 2930 Häuser umfassende *mega-site* von Maidanetske, Ukraine gehört in die Phase Trypillia CI und zur Tomashivka Lokalgruppe und wird in die Zeit von 3990–3640 cal BC datiert (Ohlrau 2020, 226). Ausgegraben wurde die lediglich 19 x 10 m große Megastruktur Nr. 3, im nordöstlichen Bereich des Ring-Korridors. Die wahrscheinlichste Datierung fällt ins 38. Jh. v. Chr. (Hofmann *et al.* 2019, 14–16). In dieser Ring-Straße liegen mehrere Megastrukturen in mehr oder weniger gleichem Abstand zueinander. Insgesamt konnten 13 unterschiedlich große Megastrukturen in Maidanetske beschrieben werden. Unterschieden werden solche mit 150–200 m², 200–300 m² und nochmals deutlich größere bis 575 m² (z. B. Ohlrau 2015; 2020; 2022; Müller *et al.* 2018, 254, 256 Abb. 9). Insbesondere die Größeren liegen in der Ring-Straße. Andere orientieren sich parallel zur Straße und rechtwinklig zu den ringförmigen Häuserreihen.

Unter der ausgegrabenen, vergleichsweise kleinen Megastruktur 3 konnten Gruben einer älteren Phase festgestellt werden, die vermutlich zu älteren Häusern gehörten. Die Verteilung des gebrannten Lehms wird analog zu Nebelivka so interpretiert, dass nur ein Teilbereich überdacht war. Mit Hilfe der Fundverteilung argumentieren die Bearbeiter für verschiedene Aktivitätszonen im Inneren und äußeren des überdachten Bereichs, wobei auffällig ist, dass die Datenbasis teilweise sehr gering ist (Hofmann *et al.* 2019, 13–29).

Megastruktur 3 gilt als Zentrum eines sogenannten Quartiers aus 50–150 Haushalten, die in *lineages* organisiert sein und überhaushaltsgroße Wirtschaftseinheiten darstellen sollen (Hofmann *et al.* 2019; Hofmann *et al.* 2024b).

An den bisher genannten Fundplätzen wurden die Megastrukturen vollständig ausgegraben. Dies ist nicht der Fall in Dobrovody. In dieser 150–250 ha großen *mega-site*, die in die Zeit zwischen 3890–3720 cal BC und Trypillia B2 datiert wird und die in die Tomashovka

Lokalgruppe gehört (Shatilo 2021, 131; Rud *et al.* 2024), befindet sich eine Megastruktur von 46 x 26 m (1196 m²) im Ring-Korridor. Lediglich eine Sondage von 144 m² wurde bisher angelegt (Korvin-Piotrovsky *et al.* 2015; 2016; Hofmann *et al.* 2019, 33–34; Gaydarska *et al.* 2020a, 211; Shatilo 2021, 130–131). Aufgrund der geringen Menge an gebranntem Lehm und der geringen Fundmenge wird der Befund als *“unroofed enclosure for unspecified socio-economic purposes”* interpretiert (entspr. nach Hofmann *et al.* 2019, 33).

DER FUNDPLATZ STĂUCENI-„HOLM“

Entdeckt wurde die Cucuteni Siedlung Stăuceni-„Holm“, Kreis Botoșani 1952 durch Ion Nestor.¹ Im Jahre 2019 fand Adela Kovács vom Historischen Museum Botoșani Keramik der Phase Cucuteni A3 am Fundplatz. Es folgten geomagnetische Prospektionen und Feldbegehungen des Instituts für Ur- und Frühgeschichte der Universität Erlangen-Nürnberg unter der Leitung von Carsten Mischka in den Jahren 2021 bis 2023. Die erste Ausgrabung fand im Jahre 2023 als Lehr- und Forschungsgrabung mit Studierenden aus Erlangen und Rumänien unter der Leitung von Adela Kovács sowie Doris und Carsten Mischka statt.

Die ca. 4 ha große Siedlung liegt auf einem Plateau ca. 6 km östlich der Stadt Botoșani, am Nordosthang des Sitna-Flußtals. Bei dem sich am Fuß des Plateaus befindlichen See handelt es sich um einen modernen Stausee. Das Siedlungsareal war mit mindestens 45 Häusern dicht bebaut. Entlang der Ostflanke ist ein Teil der Siedlung der Erosion zum Opfer gefallen. Zahlreiche Oberflächenfunde belegen weitere, mittlerweile zerstörte Hausbefunde.

Neben den Hausbefunden zeigt das Magnetogramm im Süden und Osten ein mehrfaches Graben- und Palisadensystem. Wird der innere Graben in den erodierten Bereichen ergänzt, ergibt sich eine annähernd rechteckige Siedlungsfläche, vergleichbar zu jener in Scânteia bei Iași (Drummer *et al.* 2019a; 2019b; Lazarovici *et al.* 2019).

Bei Betrachtung des Siedlungsplans fällt auf, dass die Häuser etwa West-Ost gerichtet sind und in 5–6 unregelmäßigen Reihen liegen. Im Süden, im Bereich der Gräben und Palisaden, müsste die chronologische Abfolge zwischen den verschiedenen Befunden durch Grabungen festgestellt werden. An dieser Stelle finden sich auch zwei besondere Befunde:

Erstens: ein von uns aufgrund der Größe als Megastruktur angesprochenes Gebäude von ca. 35 x 10 m (~350 m²) Ausdehnung in gleicher Orientierung wie die anderen Gebäude.

Zweitens: Ein um 90° dazu gedrehtes etwas größeres Gebäude, welches den inneren Graben schneidet oder von diesem geschnitten wird. Auch ganz am Nordende des Fundplatzes befindet sich eine Anomalie, die zu einem ebenfalls eher Nord-Süd-ausgerichteten Gebäude passen könnte. Vorläufig gehen wir aufgrund der Überschneidung von mindestens zwei Bauphasen der Siedlung aus.

Das ganze Plateau ist von weiteren kleineren rundlichen Anomalien überzogen, bei denen es sich um Gruben oder Teile unverbrannter Häuser handeln könnte.

In den Jahren 2021–2023 fanden systematische Oberflächenabsammlungen in 10 x 10 m Quadraten in den erodierten Bereichen, sowie in Radien von 8 m um die noch lokalisierbaren Hausbefunde herum statt. Diese sind zurzeit noch nicht abschließend ausgewertet, sollen aber die zeitliche Tiefe der Besiedlung und gegebenenfalls raum-zeitliche Schwerpunkte sichtbar machen. Unter den Funden befinden sich mindestens 30 Fragmente anthropomorpher Statuetten, von denen einige bereits in einem Katalog vorgelegt sind (Kovács *et al.* 2023).

Im Jahre 2023 wurden die ersten beiden Schnitte an der Südwestecke der Megastruktur angelegt. Nur der westliche Schnitt konnte bisher abschließend ausgegraben werden. Die Grabung erfolgte in einer Kombination aus natürlichen und künstlichen Schichten. In einem ersten Schritt erfolgte die Freilegung der Brandlehm-packung (*chirpici*). Es folgte die Entfernung dieses Brandlehms und die Freilegung der Abdrücke der ehemaligen Holzkonstruktion des Fußbodens (Abb. 3). Dieser war

1 <http://ran-tmp.cimec.ro/sel.asp?descript=stauceni-stauceni-botosani-asezarea-cucuteni-de-la-stauceni-dealul-holm-cod-sit-ran-35893.01> ; letzter Zugriff 10. Januar 2025



Abb. 3. Stăuceni-„Holm“. Arbeitsfoto. Zum Teil ist der verbrannte Lehm des Fußbodens bereits entnommen und die darunter liegenden Abdrücke der halbierten Stämme liegen frei (Foto: Institut für Ur- und Frühgeschichte, Friedrich-Alexander-Universität Erlangen-Nürnberg).

ursprünglich aus längs gespaltenen Baumstämmen mit Durchmessern von ca. 15 cm gebildet worden. Die Halblinge wurden mit der flachen Seite nach unten ausgelegt und die gewellte Oberfläche durch den Lehmestrich nivelliert. Im nächsten Schritt wurde die Ausgrabung dann unter dem Boden abgetieft. Nach diesem Abtrag wurde im Schnitt eine erneute geomagnetische Prospektion durchgeführt (Abb. 4). Obwohl mit bloßem Auge keine Befunde zu sehen waren, konnten ca. 50 cm unterhalb des Fußbodens weiterhin der als Fundamentgraben interpretierte umlaufende Graben erkannt werden. Dieser wurde mehrfach, unter anderem in der Südwestecke des Gebäudes, geschnitten. Es stellte sich heraus, dass mehrere sehr tiefe Gruben (> 1,20 m unter Geländeoberkante) vom Graben ausgehend eingegraben worden waren, die mit hoher Wahrscheinlichkeit zur Aufnahme von Pfosten dienten (Abb. 5). Nahe des Nordprofils und damit etwa in der Längsachse der Megastruktur gelegen, fand sich am Boden einer solchen tiefen Grube ein klein fragmentiertes, sehr dünnwandiges Gefäß (Abb. 6). In der benachbarten Pfostengrube waren große Stücke von Brandlehm zur Verkeilung

des Pfostens genutzt worden. Die Schichtung dieses Brandlehms lässt vermuten, dass er ursprünglich von einer Wand stammt, die mehrfach oberflächlich neu „beschichtet“ wurde. Es handelt sich somit um eine Art Spolie, eine Wiederverwendung älterer Architekturteile. Inneneinbauten unter dem Hausboden konnten bislang nicht beobachtet werden. Auch in der Geomagnetik fanden sich keine über den Wandgraben hinaus gehende Befunde unter dem Fußbodenniveau. Wohl aber lagen an mehreren Stellen Konzentrationen von Keramikscherben. In den archäobotanischen Proben fanden sich kleinste Silextrümmer, die auf Feuersteinbearbeitung hindeuten, sei es für eine Produktion von Geräten oder deren Nachschärfung. Insgesamt 87 Silexartefakte konnten aus dem gegrabenen Teil der Megastruktur geborgen werden, davon war ungefähr die Hälfte verbrannt. Neun Holzkohleproben wurden inzwischen von Sebastian Million als Eichenholz mit Durchmessern von mehr als 10 cm bestimmt. Lediglich eine Probe war nicht bestimmbar. Esche, das dominante Holz in Maidanetske (Hofmann *et al.* 2019, 16), ist bislang in Stăuceni-„Holm“ nicht belegt.

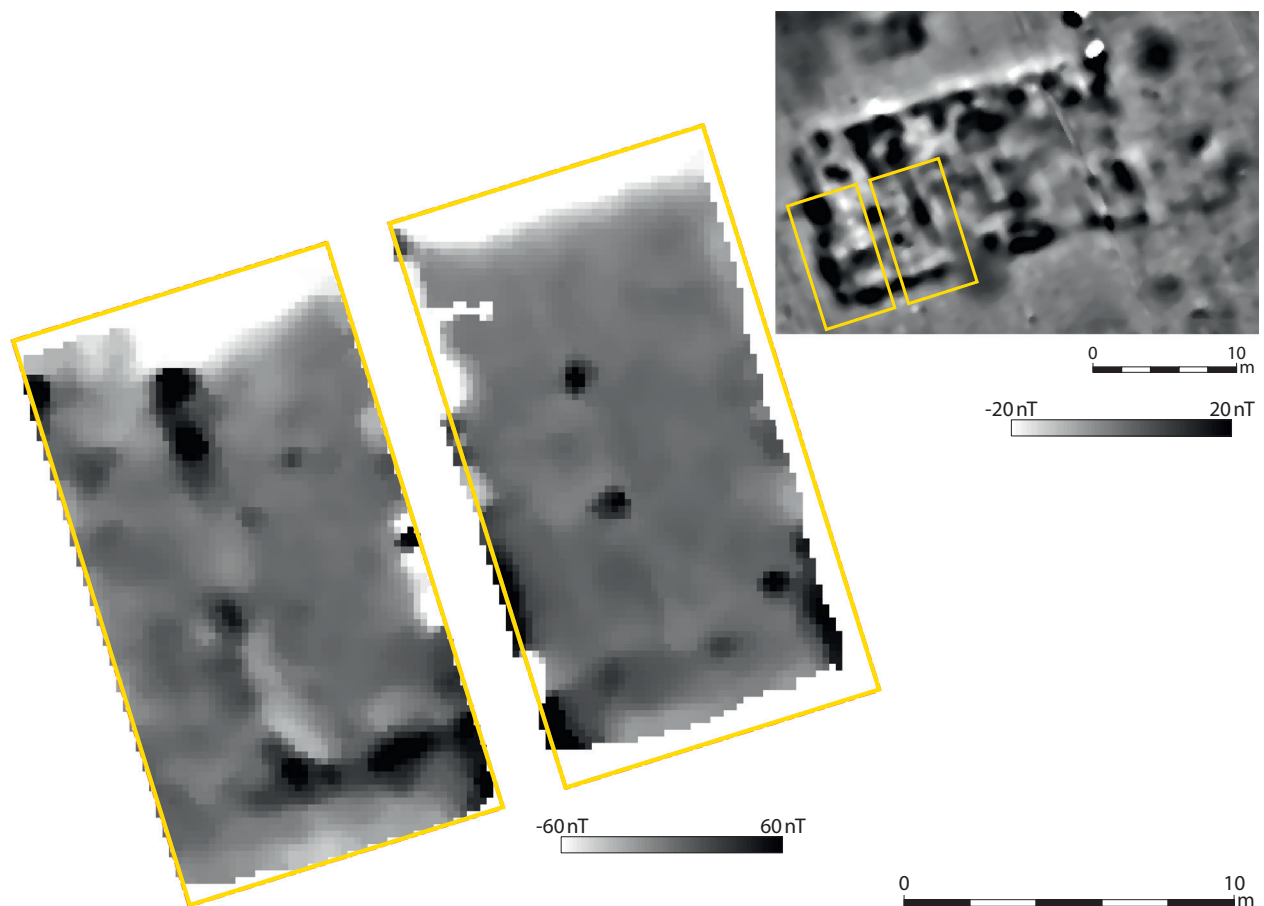


Abb. 4. Stăuceni-„Holm“. **Rechts oben:** Die Megastruktur im ursprünglichen Magnetogramm mit vermeintlich erkennbaren Innenstrukturen; **links:** das nach Entfernung der verbrannten Lehmreste gemessene Magnetogramm zeigt nur noch wenige Befunde, darunter vor allem den umlaufenden Fundamentgraben (Grafik: Carsten Mischka).

Das oben beschriebene Gefäß aus der Pfostengrube konnte weitgehend restauriert werden. Es weist ein bauchiges s-Profil auf, ist mit breiten Ritzlinien verziert und zeigt Reste roter Bemalung (Abb. 6). Horizontale Linien betonen den Übergang vom Rand zum Hals bzw. zur Schulter des Gefäßes und den oberen Bauchteil. Eine große breite Doppellinie findet sich auf dem Gefäßbauch. Auf einer Seite wurde eine schwach erhabene horizontal durchbohrte Knubbe im Zentrum der Kreisverzierung angebracht. Offensichtlich ist das Töpfchen bei seiner Deponierung in der Grube vollständig zerprungen. Ein nahezu identisches Gefäß, welches ebenfalls sicher in die Phase Cucuteni A3 datiert werden kann, ist aus Truşeşti überliefert (Petrescu-Dîmboviţa *et al.* 1999, 275 Abb. 170.7). Von dort stammt auch ein weiteres, sehr ähnlich verziertes Becherchen (*ibid.*, 276 Abb. 170.3).

Unter den Funden des Fundplatzes, finden sich auch Fragmente von Löffeln und ihren Stielen, Miniaturtische („Altäre“) sowie zoomorphe Protome und Fragmente weiblicher und männlicher anthropomorpher Statuetten, darunter einige mit Ritzverzierungen.



Abb. 5. Stăuceni-„Holm“. Profil durch den Fundamentgraben und ein Pfostenloch, welches mit einem Bruchstück gebrannten Lehms, das ursprünglich von einer Gebäudewand stammt, verkeilt ist (Foto: Institut für Ur- und Frühgeschichte, Friedrich-Alexander-Universität Erlangen-Nürnberg).



Abb. 6. Stăuceni-„Holm“. Kleiner, ritzverzierter und bemalter Becher der Phase Cucuteni A3 aus einer der Pfostengruben im Fundamentgraben (Foto und Profilzeichnung: Adela Kovács).

ERGEBNISSE ZUR MEGASTRUKTUR VON STĂUCENI-„HOLM“

Obwohl die Megastruktur von Stăuceni-„Holm“ nur zu einem kleinen Teil (ca. 25 %) in der Grabung aus dem Jahre 2023 erfasst wurde, haben sich bereits interessante Details zu erkennen geben und folgende Feststellungen können gemacht werden:

1. Die Megastruktur verfügte über einen speziell hergestellten Fußboden aus Baum-Spältlingen, die mit der flachen Seite nach unten ausgelegt worden sind und mit einem Estrich aus gebranntem Lehm versiegelt waren.
2. Diese Bodenkonstruktion ist von einem umlaufenden Fundamentgraben, vom dem etwa die untersten 20–30 cm erhalten sind, umgeben.
3. In diesem Graben wurden in mehr oder weniger regelmäßigen Abständen Gruben eingetieft, die zur Aufnahme von vertikalen Pfosten dienten. Die Gruben waren z. T. mehr als 1,20 m unterhalb der heutigen Geländeoberfläche noch anzutreffen. Am wahrscheinlichsten erscheint uns aktuell, dass diese Pfosten um die Megastruktur herum für eine Wandkonstruktion genutzt wurden.
4. In den Profilen durch den Fundamentgraben und die Pfostengruben sind noch die Pfostenstandspuren enthalten, sowie auch Fundmaterial, das zur Verkeilung der Pfosten gedient hat. Diese Verkei-

- lung erfolgte vom Inneren der Megastruktur aus und bestand u. a. aus sekundär genutzten Wandfragmenten älterer Gebäude. Daraus ergibt sich mindestens eine Zweiphasigkeit der Siedlung, bei der die Megastruktur als jüngerer Befund Bauteile älterer Bauten inkorporiert hat. Als Hypothese könnte formuliert werden, dass die Megastruktur zur jüngsten Phase von Stăuceni-„Holm“ gehört.
5. Die Entdeckung eines stark fragmentierten Gefäßes am Boden einer Pfostengrube muss vom Bau der Anlage stammen. In anderen Cucuteni-A-Siedlungen der Gegend treten solche Gefäße ebenfalls auf (vgl. Fundplatz Trușești).
 6. Im Bezug auf die Ausgrabungstechnik waren v. a. die geomagnetischen Messungen der Zwischenplana erhellend. Diese Methode sollte auf Cucuteni-Trypilia-Grabungen standardmäßig durchgeführt werden. Es zeigte sich, dass die im ursprünglichen Magnetogramm sichtbaren, rundlich begrenzten kleinen starken Anomalien im „Hausbereich“ nicht von Grubenbefunden, Öfen, Herdstellen oder sonstigen Einbauten stammten (zumindest nicht im ausgegrabenen Teil), sondern nur durch die unterschiedliche Struktur und Stärke der Lehm-packung des Fußbodens verursacht wurde. Nach der Entfernung des gebrannten Lehms verschwanden diese

Anomalien weitgehend in der Magnetik. Der Fundamentgraben war jedoch weiterhin deutlich als Anomalie zu erkennen.

7. Obwohl die Funde noch nicht abschließend analysiert sind, lässt sich im Vergleich zu „normalen Wohnhäusern“ festhalten, dass relativ wenige Funde, insbesondere Keramikgefäße angetroffen wurden. Von der ursprünglichen Bemalung sind nur noch Reste erhalten, was vermutlich auf den

Düngereinsatz der letzten 10–15 Jahre zurückzuführen ist. Die 87 Feuersteinartefakte sind aufgrund fehlender Vergleichsstatistiken nicht gut zu beurteilen. Die Hälfte der Stücke ist verbrannt, was im Inneren eines abgebrannten Gebäudes nicht weiter verwundert. Wenige Tierprotome und Bruchstücke zoomorpher Figürchen entsprechen dem üblichen Repertoire auf Cucuteni-Siedlungen, weitere Sonderfunde wurden nicht gemacht.

DISKUSSION

Obwohl die Grabungen in Stăuceni-Holm noch nicht abgeschlossen sind, können wir bereits an dieser Stelle die Ergebnisse bezüglich des Aufbaus und des Charakters des angetroffenen Fundmaterials bestätigen und weitere Beobachtungen ergänzen (Chapman *et al.* 2014a; 2014b; Ursu und Țerna 2015; Gaydarska *et al.* 2019; Hofmann *et al.* 2019;).

Lage, Datierung und Fundamentgraben

Stăuceni-„Holm“ liegt am südwestlichen Rand des Verbreitungsgebiets von Megastrukturen und gehört gemäß der Keramiktypochronologie in die Phase Cucuteni A3 (ca. 4350–4050 v. Chr.). Ein typisches Cucuteni A3-Töpfchen gelangte während der Bauzeit in eine Pfostengrube im Fundamentgraben. Die Megastruktur in Stăuceni-„Holm“ konnte bisher noch nicht absolut datiert werden.

Am Fundplatz Baia liegen bezüglich des Fundamentgräbchens und der Pfostengruben gleichartige Befunde vor, die jedoch in die späte Phase von Precucuteni I (ca. 5000–4900 v. Chr.) datiert werden und damit viel älter sind als die Befunde in Stăuceni-„Holm“. In den Profilzeichnungen von Baia ist zu erkennen, dass Gruben und Gräbchen unmittelbar unter dem Fußbodenniveau erkennbar waren (Ursu und Țerna 2015, 50 Abb. 3). Die publizierten Fotos lassen keinen Zweifel an der guten Erkennbarkeit der Befunde im Profil. Unklar ist, ob sie auch im Planum so gut erkennbar waren. Sie könnten erst beim Schneiden der Megastruktur erkannt worden sein. Leider ist die Lage der Profile nicht im Plan markiert (*ibid.*, 49–50 Abb. 2–3).

Nichtsdestotrotz ist die Anlage in Stăuceni-„Holm“ älter als die Befunde in der Ukraine. Weder in Nebelivka (3990/3840–3850–3740 BC [Trypillia BII]), noch in Maidanetske (ca. 38. Jh. v. Chr.) wurden Fundamentgräbchen erfasst. Dort fanden keine geophysikalischen Messungen während des Grabungsfortschritts mehr statt und es wäre möglich, dass die Gräbchen nicht erkannt wurden. John Chapman *et al.* schließen Gräbchen für Nebelivka an sich nicht aus, die aber bei der

angewendeten Grabungstechnik nicht hätten nachgewiesen werden können (Chapman *et al.* 2014a, 140).

In Maidanetske wurden unter der Megastruktur 3 Gruben und ältere Siedlungsschichten entdeckt. Gemäß der veröffentlichten Profile lagen sie unmittelbar unter dem Fußbodenniveau bzw. der Lehm-packung (Hofmann *et al.* 2019, 19 Abb. 6). Ein Profil durch die Außengrenzen der Megastruktur liegt nicht vor, so muss offen bleiben, ob hier ein potentiell Gräbchen verlaufen ist. In Stăuceni wurde das Gräbchen im Planum erst nach 20–30 cm Abtrag eines vermeintlich sterilen Bodens schwach sichtbar und wäre ohne geomagnetische Anomalien vermutlich unerkant geblieben.

Es wäre möglich, dass die Gräbchen in jüngeren Anlagen kein notwendiges Bauelement mehr waren oder dass sie in den weiter östlich gelegenen Anlagen nicht angelegt wurden.

An beiden ukrainischen Plätzen gehörte die Megastruktur gemäß den stratigraphischen Beobachtungen nicht zur ersten Besiedlungsphase; auch dort sind die Anlagen abgebrannt.

Fußboden und Wände

Der verbrannte Lehm gehört größtenteils zum Fußboden. Bisher ist nur in Stăuceni-„Holm“ ein solcher Fußboden in einer Megastruktur entdeckt worden. Es bleibt auch hier unklar, wie genau potentielle Wände ausgesehen haben. Möglicherweise lagen im Fundamentgräbchen Querträger, in denen aufgehende Elemente zwischen den tief eingegraben „Hauptpfosten“ verankert waren. Aufgrund der Eingrabungstiefe dieser Hauptpfosten wäre eine Dachkonstruktion nicht undenkbar. Binneninstallationen wurden bisher nicht erfasst. Da aber erst ein kleiner Teil der Megastruktur ausgegraben ist, werden diese in den folgenden Kampagnen erwartet. Ebenfalls wird zu erfassen sein, ob der Lehmfußboden flächendeckend ausgeführt wurde. Dies wäre ein Argument dafür, dass der Megastruktur ein Baukonzept zugrunde liegt, dass in kurzer Bauzeit umgesetzt wurde. Alternativ könnten auch sukzessive

Anbauten erfolgt sein, die im Magnetikplan nur den Eindruck eines Großbaus erzeugen, sich aber in der Ausgrabung als Bauabfolge zu erkennen geben.

Einbauten

Bislang konnten in Stăuceni-„Holm“ keine internen Einbauten wie Öfen, Herde, Plattformen o. ä. ausgegraben werden. Die Anomalien, die im Magnetogramm auf solche Befunde hinwiesen, erwiesen sich alle als durch die verbrannten Fußbodenreste erzeugt. Dies ist insofern bedeutend, weil Robert Hofmann und seine Co-Autoren mit Hilfe der An- oder Abwesenheit interner Magnetikanomalien eine Klassifikation der Megastrukturen vornehmen (Hofmann *et al.* 2019, 37–40). Die hier erfassten Befunde deuten eher auf besonders viel verwendeten Lehm in manchen Megastrukturen hin oder, dort wo diese starken Anomalien fehlen könnte auch die Erosion schon stärker zum Tragen gekommen sein. Dass bislang der Lehm in Stăuceni-„Holm“ ausschließlich vom Fußbodenestrich stammt, kann sicher nicht auf alle Megastrukturen zu übertragen werden. An anderen Fundstellen stammt der Lehm von den Wänden, so dass höhere Konzentrationen im Planum durchaus auf die Verstürze der Wände hindeuten können. Jedoch ist die Auswertung allein anhand von geomagnetischen Messbildern hier kritisch zu werten.

Funde und Funktion

Die geringe Menge von Funden und der Charakter des Inventars, die einem typischen „Wohnhaus“ entsprechen, wurde auch in den anderen Ausgrabungen von Megastrukturen beobachtet, mit Ausnahme von Baia, wo eine enorme Menge an Gefäßen und besondere anthropomorphe Gefäßverzierungen beschrieben wurden. Das bisherige Inventar in Stăuceni-„Holm“ besteht zwar immerhin aus 87 Silices, Mahlsteine fehlen aber bislang und unter den verbrannten Pflanzenresten konnten noch keine Getreidereste nachgewiesen werden, wobei die Auswertung hier noch nicht abgeschlossen ist. Wenn das Gebäude also vor Verlassen nicht sorgfältig gereinigt wurde, ist eine Funktion als Magazin oder Konsumptionsplatz der Dorfgemeinschaft eher nicht wahrscheinlich.

Auch für rituelle Aktivitäten gibt es keine klaren Hinweise. Vielleicht waren die Megastrukturen einfach nur Häuser für größere Familien oder Gemeindegebäude zur Beratung über die Siedlungsgeschicke oder Treffpunkte für bestimmte Teile der Bevölkerung, seien es, Männer- oder Frauenhäuser, die Plätze zum Festlegen des einheitlichen Bebauungskonzepts oder auch die Treffpunkte für hierarchisch höher gestellte Personen (vgl. Chernovol 2023).

BEDEUTUNG DER MEGASTRUKTUREN IN PRECUCUTENI UND CUCUTENI A KONTEXTEN

Robert Hofmann *et al.* 2019 schlagen vor, die Megastrukturen als Teil der politischen, ökonomischen und sozialen Organisation von *mega-sites* zu interpretieren. Für ihre weitere Deutung ist die Lage, Größe und Datierung der unterschiedlichen Megastrukturen in den *mega-sites* entscheidend. Sie gehen davon aus, dass die besonders großen Anlagen im Bereich von Plätzen (Lage-Typen P1 und P2), vermutlich im Bereich des Hauptzugangs ins Innere die jüngsten Anlagen liegen. Sie verstehen dies als Hinweis auf eine zunehmende Hierarchisierung der Siedlungen, die jedoch nicht mehr lange von der Bevölkerung geteilt wird, und sich als Gesamtphänomen auflöst.

Stăuceni-„Holm“ ist weder eine Ringsiedlung noch eine *mega-site*. Jedoch handelt es sich bei dieser Siedlung um eine Anlage, die mit Grabensystem eingefasst ist, wie es typisch für Precucuteni- und Cucuteni-Siedlungen ist, nicht jedoch für die *mega-sites*. Die Anlage von Stăuceni-„Holm“ ist älter als die *mega-sites* der Ukraine, jedoch viel jünger, als die Anlage von Baia, welche bereits ins späte Precucuteni I datiert wird. In Baia befindet sich die Megastruktur zudem im Zentrum der Siedlung, in Stăuceni-„Holm“ am äußeren Rand,

jedoch nahe des Eingangs. Hier ist allerdings die zeitliche Abfolge zwischen den Gräben und anderen Häusern noch nicht geklärt. Sicher ist jedoch, dass der Bau gut sichtbar gewesen sein muss. Am ehesten entspricht die Position der Anlage P5, also vor der äußersten Besiedlungsreihe, in den *mega-sites*.

Zurzeit gehen wir von einer vergleichsweise späten Datierung innerhalb der Gesamtsiedlung aus. Dies basiert auf den Funden von älterem Siedlungsmaterial, welches zur Verkeilung der Pfosten in den Fundamentgräbchen genutzt wurde. Für die Gesamtgröße der Siedlung mit ca. 45 Häusern erscheint eine Megastruktur zur Organisation zunächst unnötig. Es scheint jedoch so, dass die Megastrukturen schon seit der Stufe Precucuteni I ein zentrales und regelhaft auftretendes Element in den Siedlungen darstellen, welches über 800–1000 Jahre genutzt wird. Daher ist die Deutung, dass es sich um eine Verwaltung der Anlagen notwendigen Bestandteil handelt, weiterhin vorherrschend (vgl. auch Ohlrau und Rud 2019, 94). Es kann daher angenommen werden, dass seit der Precucuteni-Zeit Siedlungen ab einer bestimmten Größe modular aufgebaut wurden und, sobald eine gewisse Größe überschritten

wurde, weitere Megastrukturen hinzukamen, um alle Haushalte „zu versorgen“. Wenn dies der Fall ist, hätten die Bewohner ein „Werkzeug“ gefunden, um sehr große Siedlungen mit vielen Hunderten Einwohner über

Jahrhunderte managen zu können (vgl. Fletcher 1995), wie auch immer dies im Detail gestaltet gewesen sein mag.

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Then and Now — Changing Perspectives and New Advances in the Research on Neolithic Tells and Single-Layer Nucleated Settlements in the Tisza Region

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KEYWORDS: Carpathian Basin, Tisza region, Late Neolithic, settlement structure, tell and tell-like settlements

Abstract

Research into the Late Neolithic on the Alföld (Great Hungarian Plain) is of primary importance for the archaeology of the Carpathian Basin since this was the region that separated Southeast Europe from the Central European cultural orbit in the fifth millennium cal BCE. In this sense, the Alföld tell sites, tell-like sites and single-layer settlements formed both a transition zone and a central area. Engaged in the research

of this extraordinary socio-economic phenomenon, the authors of the present study have not only keenly followed the jubilarian's work and publications, but have quite often contributed to creative debate and discussion sessions. This short paper seeks to offer a concise summary of diverse spatial and social patterns as a tribute to the academic life and work of our dear colleague and friend, Johannes Müller.

Zusammenfassung

Für die Archäologie des Karpatenbeckens ist die Erforschung des Spätneolithikums in der Großen Ungarischen Tiefebene (Alföld) von größter Bedeutung, da diese Region im fünften Jahrtausend v. Chr. eine Grenze zwischen Südosteuropa und dem mitteleuropäischen Kulturkreis darstellte. Dabei bilden die Alföld-Tells, tell-ähnlichen Fundstellen und die einschichtigen Siedlungen sowohl eine Übergangszone als auch einen zentralen Bereich zwischen den Regionen. Im Rahmen der Forschungen zu

diesem außergewöhnlichen sozioökonomischen Phänomen haben die Autoren dieser Studie nicht nur die Arbeiten und Publikationen des Jubilars mit Begeisterung verfolgt, sondern auch mehrfach zu kreativen Debatten und Diskussionsrunden beigetragen. Dieser kurze Beitrag soll eine kurze Zusammenfassung der verschiedenen räumlichen und sozialen Muster bieten, um das akademische Leben und Werk unseres lieben Kollegen und Freundes Johannes Müller zu würdigen.

Összefoglalás

Az Alföld (Nagy Magyar Alföld) késő neolitikumának kutatása elsődleges fontosságú a Kárpát-medence régészetében, mivel ez volt az a régió, amely a Kr. e. 5. évezredben elválasztotta Délkelet-Európát a közép-európai kultúrkörzettől. Ebben az értelemben az alföldi tell és tell-szerű lelőhelyek és egyrétegű települések egyszerre képeztek átmeneti zónát és központi területet. E rendkívüli társadalmi-gazdasági jelenség kutatásába

bekapcsolódva jelen tanulmány szerzői nemcsak a jubileumi munkákat és publikációkat követték lelkesen, hanem nemegyszer kreatív vitákhoz és vitáülésekhez is hozzájárultak. Ez a rövid írás a változatos térbeli és társadalmi minták tömör összefoglalását kívánja nyújtani, tisztelgésként kedves kollégánk és barátunk, Johannes Müller tudományos élete és munkássága előtt.

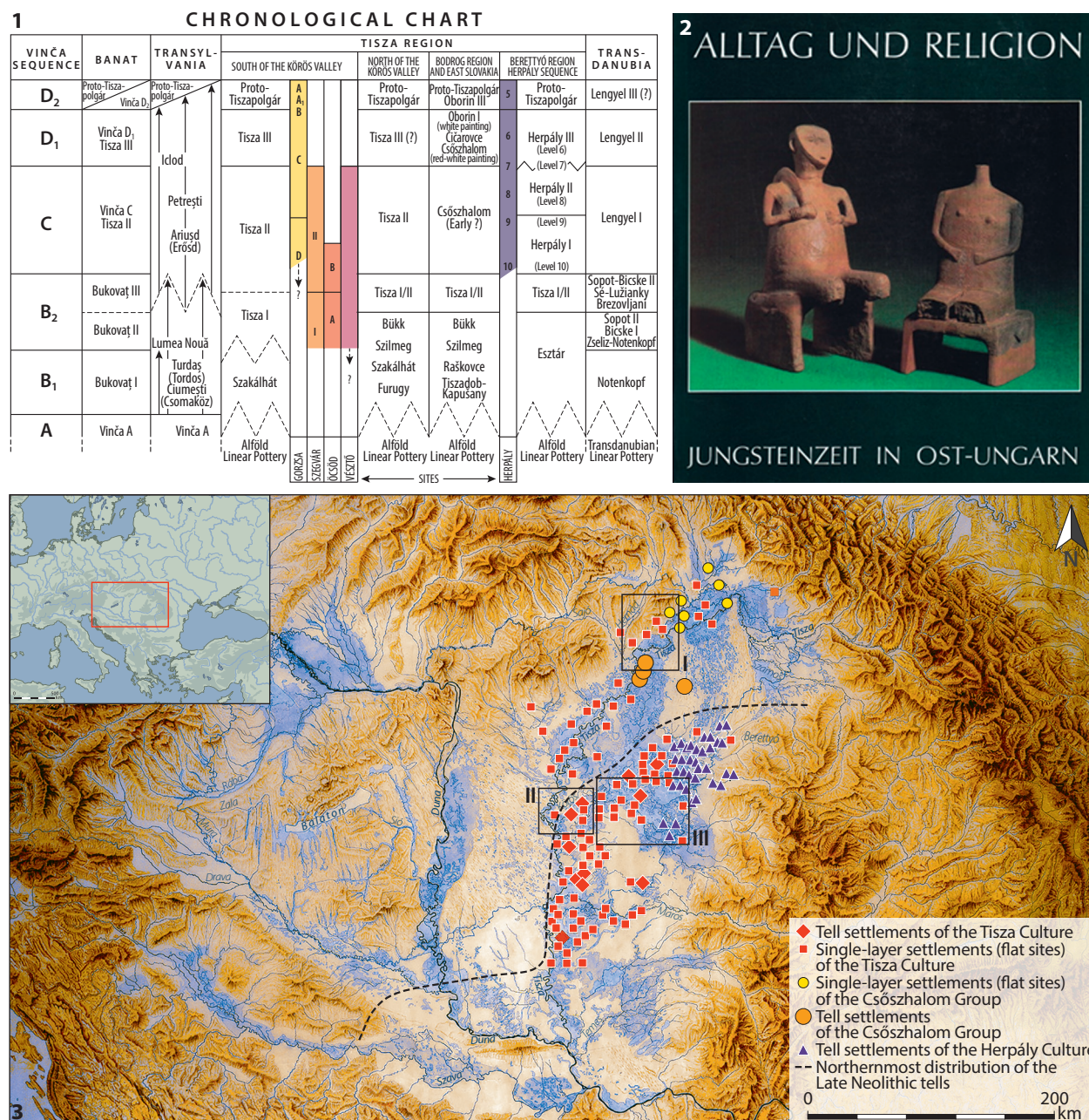


Fig. 1–2 The chronological chart from the catalogue accompanying the international exhibition showcasing the Late Neolithic of the Tisza region between 1987 and 1991, published in Frankfurt a. M. in 1990; 3 Distribution of the Late Neolithic tells, tell-like sites and single-layer settlements of the Tisza-Herpály-Csöszhalom cultural areas on the Hungarian Plain. The map based on the archaeological record of 1990 shows the northern boundary of the distribution of stratified mounds and the regions covered by major regional research projects: I Upper Tisza Project (UTP), II Tiszazug Micro-Regional Project (TMRP), III Körös Regional Archaeological Project (KRAP) (Graphic: András Füzesi; small map: Karin Winter).

LATE NEOLITHIC SETTLEMENTS IN THE TISZA REGION: PREVIOUS RESEARCH AND CURRENT QUESTIONS

The thematic exhibition at the turn of the 1980s and 1990s, which showcased the settlement mounds of Hódmezővásárhely-Gorzsa, Szegvár-Tűzköves, Öcsöd-Kováshalom, Vésztő-Mágor and Berettyóújfalu-Herpály in the southern Alföld and their finds represented an

important milestone in the research of the Late Neolithic of the Tisza region. This exhibition later toured several cities in Germany and France (Fig. 1) and was accompanied by catalogues in English, German and French featuring thematic studies that offered a

detailed overview of the sites and the find assemblages brought to light during their investigation (Tálas and Raczky 1987; Meier-Arendt 1990; Jannet-Vallat and Thevenot 1991). The results of the archaeological exploration of these settlements that had only been partially published at the time thus became accessible to international archaeological scholarship, alongside the relevant literature on these sites. The authors of the studies published in the exhibition catalogues came to a consensus regarding the most relevant issues in the study of the Late Neolithic of the Alföld, particularly regarding the interpretation of tells, whose main points were discussed in a theoretical overview accompanied by a gazetteer of sites, a distribution map and a chronological chart (Kalicz and Raczky 1987; 1990; 1991). The new theoretical perspectives in the studies written by János Makkay (1982) and Andrew Sherratt (1982) were the main inspiration for the survey of previous research. The appearance and origins of tell on the Alföld and the distribution of tells, tell-like settlements and single-layer settlements in the Tisza region as well as the interactions between them enjoyed an undisputed priority in the period's research agendas. The interpretations put forward at the time were ultimately based on the roughly century-long European research on prehistoric settlements, principally on the German and Anglo-Saxon traditions (for overviews on research history, cf. Kalicz 1986; Chapman 1989; 2009; Strahm 1995; Gogăltan 2003; 2005). The various models proposed for the emergence of the different South-East European settlement types and settlement patterns grew out of different intellectual traditions (Evans and Rasson 1984, 719). Following the logic of the general deductive model, the tells of the South-East European and Near Eastern Neolithic were conceptualised as a widespread unitary phenomenon or even cognitive schema in most of the comprehensive discussions written at the time. Moreover, despite all methodological warnings to the contrary (Wright 1974, 123), some scholars assumed an identical evolutionary trajectory and the convergent trajectory of the same social processes that led to the formation of tells in the Near East, and assumed a similar development leading to a form of early urbanism in South-East Europe and in the Late Neolithic world of the Carpathian Basin. This idea was most succinctly expressed in relation to the Alföld tells of the Tisza culture: "*The Tisza-boom derived indirectly from the diffusing stream of this pre-Uruk civilizational process*" (Makkay 2003, 498). As Tobias Kienlin pointed out, similar propositions of "proto-urban" or "chiefly" societies could also be encountered in discussions on the social background of the Bronze Age tells of the Carpathian Basin (for a comprehensive overview, cf. Kienlin 2022, 227–228, with the relevant literature).

Viewed from a wider perspective, the wealth of new information published in the overviews between 1987 and 1991 based on five Neolithic tells of the Tisza region set within the broad framework of the Carpathian Basin was integrated into the major syntheses of the European Neolithic and perhaps also acted as one of the sources inspiring these works (e.g. Hodder 1990, 55–57; Gimbutas 1991; Parzinger 1992; Raczky 1992; 2015; Lichardus and Lichardus-Itten 1995–1996; Whittle 1996, 107–113; Chapman 1997; 2020; Parkinson 2002; 2006; Schier 2005; Link 2006; Rosenstock 2009; Müller 2010; 2015; Kienlin 2015; Fischl and Krauss 2016). Yet, scrutinising these new results for information on the exact size of the settlements and to what extent the areas investigated during the excavations were representative of the entire site would have yielded rather uncertain data.

Simultaneously with the new approaches to the interpretation of the Neolithic tells of South-East Europe and eastern Hungary, the first major surveys of the Neolithic circular enclosure systems (Kreisgrabenanlage) of Transdanubia and Central Europe appeared in the archaeological literature (Kalicz 1983–84; Nemejcová-Pavúková 1986; Podborský 1988; Petrasch 1990; Trnka 1991; 2005; Pavlů *et al.* 1995; Hašek and Kovarník 1999; Kuzma 2005; Neustupný 2006; Pavúk and Karlovský 2008; Biehl 2010; Melichar and Neubauer 2010). In the wake of the new advances made in the research of these circular enclosures, the general scholarly consensus was that they functioned as special community and ritual spaces wholly separate from domestic settlements (for an overview of research history, cf. Parkinson and Duffy 2007; Literski and Nebelsick 2012; Bertók and Gáti 2014; Petrasch 2015; Neubauer 2017; Barna 2017, 152–193; Řídký 2019, 13–23; Czerniak *et al.* 2020; Henkel 2021; Vondrovský *et al.* 2022; Schier 2023a). Thus, both tells and circular enclosure systems were seen as impressive monuments constructed by larger communities of prehistoric Europe: the former was inhabited, creating thereby a certain measure of overlap between the place of residence and the community partaking in the ceremonies, while the latter were wholly separate from the daily arenas of life, meaning that the residential community and the ceremonial community were not necessarily identical. In fact, there seems to be evidence that a few larger circular enclosures had been used by the population of several neighbouring settlements. The special sites structured according to the two "architectural idioms" of the monumental represented the special central places (*Zentrale Orte*) of two cultural macro-regions whose interface lay in the Carpathian Basin (Fig. 2.1–3) (Parzinger 1992).

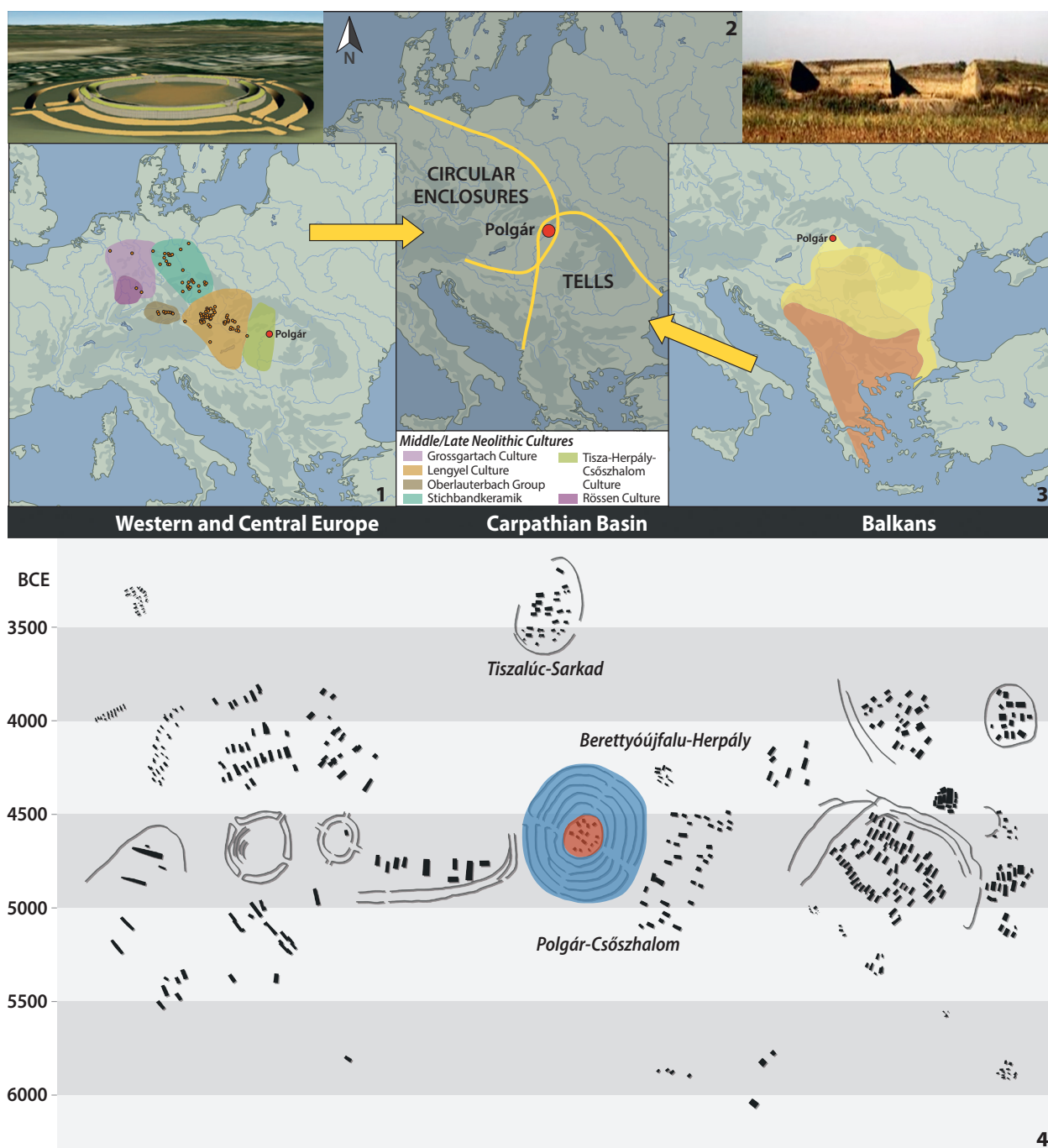


Fig. 2. 1–3 The Polgár-Csőszhalom site, encapsulating the interaction of Central European circular enclosures (rondels) and South-East European tells in the context of the local Late Neolithic. 4 Development, morphology and chronology of Neolithic and Chalcolithic settlement structures between the Aegean to Central Europe (after Müller 2010, modified by András Füzesi, maps: Karin Winter).

THE INSIGHTS AFFORDED BY THE INVESTIGATION OF THE POLGÁR-CSŐSZHALOM SETTLEMENT

The discovery of a Central European Lengyel-type circular ditched enclosure system with four entrance-ways ringing the well-known tell settlement of Polgár-Csőszhalom (Bognár-Kutzián 1966; Bánffy and Bognár-

Kutzián 2007) in the early 1990s was of immense importance in the continental-scale model outlined in the above (Raczky *et al.* 1994; Raczky 1995; Raczky *et al.* 1997). It later became clear that the tell and the

enclosure system developed at the same rhythm during the settlement's occupation, implying that the social events and the various community actions were similarly intermeshed and performed according to the same rhythm (Raczky *et al.* 2007, 53–59 fig. 2–3, 6). An even more astonishing discovery made at Polgár was that the tell-enclosure complex was surrounded by a large single-layer settlement extending over an area of 67.3 hectares as determined by the systematic magnetometer surveys conducted over the years (Fig. 3.1) (Raczky *et al.* 1997; 2002; 2007; 2014; 2015; Raczky and Anders 2008; 2010; Füzesi *et al.* 2016; Raczky 2018; Mesterházy *et al.* 2019). This settlement size in itself represented an order of magnitude that was previously unattested in the Late Neolithic cultural milieu of the Tisza-Herpály-Csőszhalom culture complex (Kalicz 2001). It seemed obvious that the emergence of this “mega-site” was the outcome of a settlement aggregation and nucleation process that occurred at the close of the preceding Alföld Linear Pottery culture (Makkay 1991; Chapman 1997) in the Upper Tisza region, in the Polgár Island micro-region (Raczky and Anders 2009a). The presence of a settlement complex made up of the tell bounded by the ditched enclosure and the single-layer settlement on the Polgár-Csőszhalom site in the late 1990s and the findings of the large-scale investigations of the contemporaneous settlements in the Balkans, principally at Okolište, Uivar, Pietrele, Podgoritsa and Sesklo published from around the 2000s (Bailey *et al.* 1998; Kotzakis 1999; Kujundžić-Vejzagić *et al.* 2004; Schier and Draşovean 2004; Hansen *et al.* 2005; 2008; Müller *et al.* 2013) led to the construction of a new model for the European Neolithic and Copper Age. Johannes Müller's chart published in 2010 presented the development and the main morphological types of the settlements flourishing between 6000 and 3500 BCE, in which the macro-structure of Polgár-Csőszhalom in the Tisza region occupied a prominent place (Müller 2010, 250 fig. 1; Fig. 2.4). The chart, a “big picture” visualisation of his summary model, was later published elsewhere, too (Müller 2014). The Polgár site furnished compelling evidence that tells and single-layer settlements had not simply co-existed during the Late Neolithic of the Tisza region, but had in fact formed a host of diverse configurations (Müller 2010, 253). One remarkable aspect of the Polgár settlement is its geometric duality: the circular structure of the tell-enclosure system with the radial alignment of the houses on the tell and the linear layout of the single-layer settlement with the axial symmetry of its houses (Raczky and Anders 2008; 2010; Bradley 2012, 141–146). During a later excavation, traces of a smaller double enclosure were found south-west of the tell-enclosure system in the centre of the single-layer settlement; however, this smaller enclosure did not have a settlement mound in its centre (Fig. 3.1): in this

respect, it resembled the round enclosures with four entrances of the Transdanubian Lengyel culture (Mesterházy *et al.* 2019, 10 figs. 6–8, 12). It would appear that this newly-discovered feature can be related to the abandonment of the tell-enclosure complex and its use-life can be dated to the final phase of the former's occupation. It seems likely that the same final process of disintegration underlay the spatial fragmentation of actions that had formerly been restricted to the tell settlement, as shown by the presence of a few strongly burnt houses north of the small enclosure on the magnetograms – burnt houses had earlier only been documented on the tell settlement (Mesterházy *et al.* 2019, 13 fig. 10).

One new element at Polgár-Csőszhalom was that in contrast to the burnt houses uncovered on the tell settlement, only the remains of unburnt buildings were found on the single-layer settlement. We assumed that the occupants had been engaged in the deliberate manipulation of fire regarding the settlement's houses in the site's different spatial segments and that deliberate house burning had been practised at Polgár, similarly as on other prehistoric settlements of the Balkans and Eastern Europe. We concurred with the concept of the house being a social entity that was born, had a biography and was then “killed” by fire (for discussions, cf. Stefanović 1997; Stefanović and Tringham 1998; Chapman 1999; 2015; Tringham 2005; 2013; Gheorghiu 2008; Bami 2014; Tasić *et al.* 2015; Chapman and Gaydarska 2018; Jordanova *et al.* 2018; Gaydarska *et al.* 2019; Filipović *et al.* 2023). We have maintained this view despite the criticism and doubts levelled at this interpretation of the burnt buildings of the South-East European Neolithic and Copper Age (Lichter 2016). Yet, the radial alignment of the houses towards the centre on the Csőszhalom tell would suggest that the burnt buildings fulfilled a higher role in creating community space, particularly in knowledge of the fact that the tell had initially accommodated no more than one or two-storeyed houses (Raczky *et al.* 2011; Raczky and Sebők 2014). The centripetal alignment of the burnt houses was first noted at the Polgár site in the Tisza region, a spatial organisation that shares similarities with Iclod in Transylvania (Mischka 2012, 154–158 fig. 5–6) and with the monumental spatial structuring principles of the Cucuteni-Tripolye culture east of the Carpathians (Ellis 1984, 183–196; Ohlrau 2015; Rassmann *et al.* 2016; Videiko and Rassmann 2016; Hofmann *et al.* 2016; Mischka *et al.* 2019; Uhl 2020). Later, comparable spatial arrangements of this geometric order were found on other settlements along the Tisza (Raczky and Anders 2014; Marić *et al.* 2016; Hofmann *et al.* 2020; Raczky *et al.* 2022). We assumed that tell-enclosure systems and burnt houses had been systematically structured into geometric macro-patterns in the eastern half of

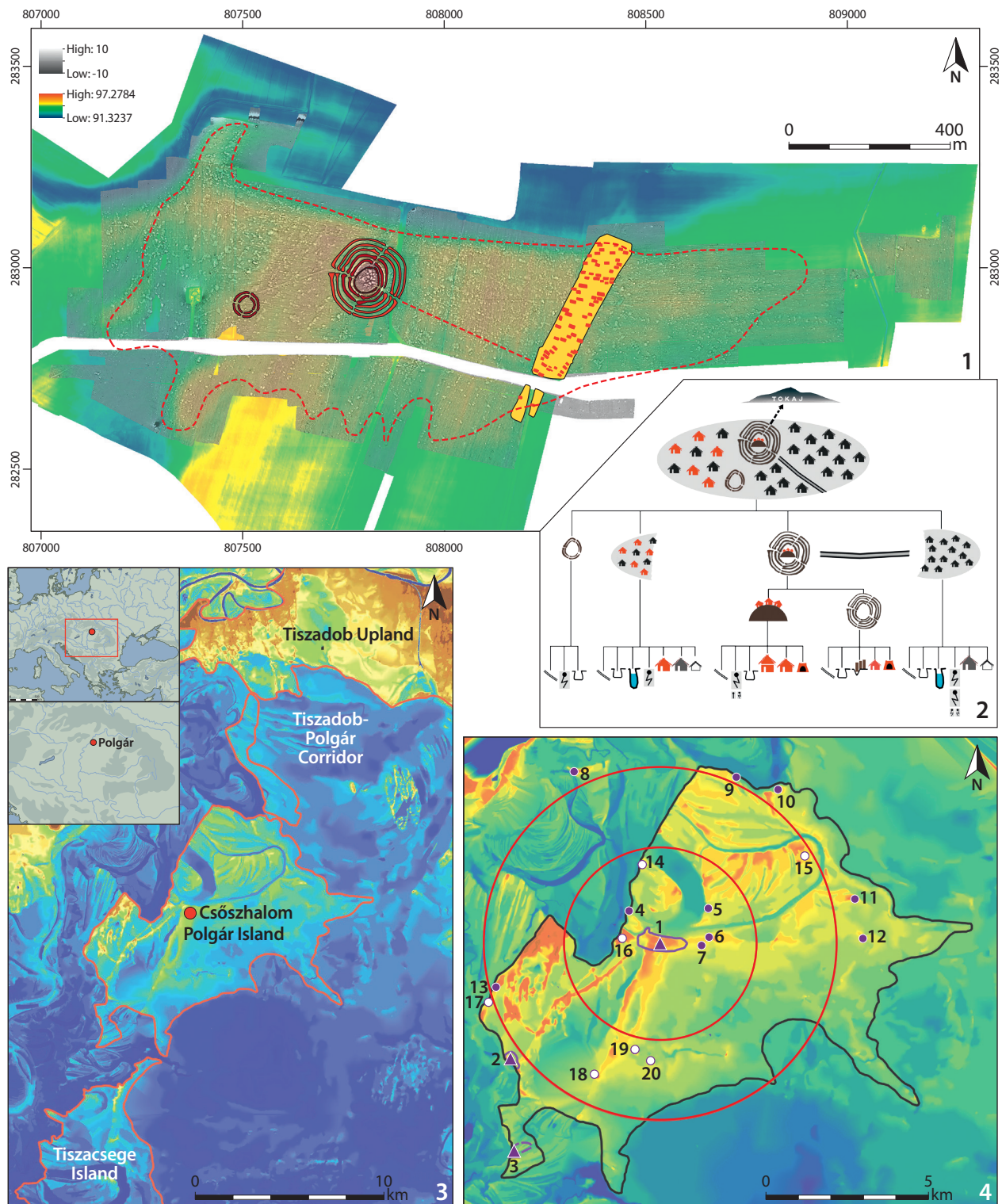


Fig. 3. 1 The boundary and main spatial structures of the Late Neolithic settlement of Polgár-Csőszhalom as revealed by the field surveys and the geomagnetic surveys; 2 Tentative model of the reconstructed spatial modules on the settlement complex of Polgár-Csőszhalom; 3 Location of Polgár-Csőszhalom on Polgár Island with the neighbouring Tisza Upland and Tiszacsege Islands in the Upper Tisza Region; 4 Polgár-Csőszhalom and the Late Neolithic settlement system on Polgár Island (Graphic: András Füzesi; small maps: Karin Winter).

the Carpathian Basin during the Late Neolithic (between 5000 and 4500 BCE), an expression of the interaction between the three monumental architectural

forms based on our observations of their intermeshing on several sites (Raczky 2019, 274 fig. 12.8; 2021, 26 fig. 1; Chapman 2020, 204 fig. 6.7).

THE SPATIAL MODULES OF THE POLGÁR-CSŐSZHALOM SETTLEMENT AND THEIR LOCAL NETWORKS

Following the initial promising results of the Polgár research project, we expanded the archaeological exploration of the site in two main directions. Inspired by one of the visual models presented by John Chapman and Bisserka Gaydarska (Chapman and Gaydarska 2007, 102 fig. 5.10), one goal was to determine the structural organisation of the settlement complex's spatial modules in order to determine the one-time activity zones and their depositional patterns (Raczky 2018, 21 fig. 3.1), which would also shed light on the temporality of certain activities (Fig. 3.2). The Alföld tells, previously regarded as static units, were now seen as multifaceted sites with a kaleidoscopic variety of features characterised by dynamically changing spatial and chronological dimensions as well as complex patterns of interactions (Souvatzi 2020, 128–131), while the spatial elements provided the different arenas of social interactions (Anders and Raczky 2013, 81 fig. 1; Raczky 2019, 278–280 fig. 12.11). The community activities associated with the Csőszhalom tell indicated that the mound was not the setting of daily life but of special community actions, ceremonial events and feasting (Raczky and Anders 2008; 2010). Additional archaeological evidence for this interpretation was provided by the identification of a road-like feature that connected the eastern part of the single-layer settlement and the south-eastern entrance of the enclosure bounding the tell on the magnetogram (Fig. 3.2, 3.4). Similar pathways are now generally interpreted as procession roads, ritual roads or *cursus* in the case of the Central European enclosures of the fifth millennium BCE on which larger numbers of participants approached the closed-off location of community rituals and ceremonies (Barna and Kalla 2023), and in this sense, the procession itself, the organised movement of a body of people, was also part of the ritual choreography. Viewed from this perspective, Csőszhalom cannot be regarded as a genuine tell *sensu stricto*, as a habitation monument, but rather as a continuously changing, artificially constructed, imposing community monument, for which the most apt description would be *Ersatz Tell*, a term coined by Andrew Sherratt (Sherratt 2005). In our model, the tell and the single-layer settlement were two co-existing and intermeshing, but nevertheless two very different larger spatial systems. A look at the material assemblages of various activities revealed that the Csőszhalom settlement complex represented a uniquely structured elaborate context

system in the Tisza region (Fig. 3.2), in which combinations of situated practices were configured.

The study of the chipped stone assemblage from Polgár-Csőszhalom shed light on another dimension of local spatiality: aside from attesting to the existence of local activity zones, it also highlighted the significant role of translocal networks and the differential use of lithic raw materials on the tell bounded by the enclosure and the single-layer settlement (Faragó 2016; 2019). We found that practice theory and the concept of communities of practices could be fruitfully applied to the Csőszhalom site (Cipolla 2014; Wenger-Trayner and Wenger-Trayner 2015), similarly as in various other case studies in prehistoric archaeology (Furholt *et al.* 2018; Kienlin 2020; 2022; Furholt 2021). The continuously changing “signal reception strength” resulting from the interplay between the triad of practices, material outcomes and social relations, which can be seen in relation to every single site, has been repeatedly accentuated, and this interpretative framework is thus also valid for the Csőszhalom site. In this context, highly significant aspects are foregrounded from the complex human activities of place-making, symbolic social storage and cultural memory-making often cited in relation to tells (Furholt and Müller 2011; Malafouris 2013).

Looking at the spatiality of the various activities at Polgár-Csőszhalom, we found that in addition to the horizontal organisation, there was another major dimension to the settlement. As a built environment, the settlement mound and the two-storey buildings in its centre (Raczky and Sebők 2014) represented what Hans Georg Gebel termed the domestication of vertical space (Gebel 2006). At the same time, we uncovered several remarkable assemblages that had been deposited in several spots of the enclosure system. For example, it is noteworthy that copper artefacts were quite often recovered from the fill of the ditches, despite the fact that they were no doubt high-prestige objects at the time. This is all the more striking in view of the fact that copper articles were found solely on the tell, while not one single copper artefact was brought to light in the 3.5 ha large excavated area of the single-layer settlement (Siklósi *et al.* 2015). At the same time, the features initially used as wells on the single-layer settlements were in several cases secondarily used for the deposition of ritual assemblages made up of unusual artefacts. Structured deposits of special vessels and various other objects forming successive layers were uncovered

in the shafts of the one-time wells (Raczký *et al.* 2005; Sebők *et al.* 2013). These structured deposits were sealed by a layer of burnt debris, suggesting the one-time presence of a less durable structure in their vicinity that left no archaeological traces after having been set on fire at the end of the ritual, whose remains were then deposited in the pit as a symbolic act of conclusion. The sequence of the events can be interpreted as leading from the horizon of the visible everyday realm to the invisible sphere of the “netherworld”.

In light of the above, we can assert that a part of the community practices of the Polgár settlement appears to have been directed above the horizon of daily life, while another is at the invisible sphere underneath it. Thus, at Polgár-Csőszhalom we can assume a mental scape articulated both vertically and horizontally, a well-structured mental microcosm (Raczký and Anders 2010, 153–156 fig. 9). This would conform to Richard Bradley’s model of the “The Monument as a Microcosm” and the visual modelling of the cognitive spheres of landscapes (Ballmer 2010, 194–195 fig. 1–2;

Bradley 2010). Moving slightly further, our earlier case studies similarly suggested that evidence for various types of symbolic social behaviour could be documented in the physical environment of Polgár-Csőszhalom (Zubrow and Daly 1999). Taking our cue from the relevant case studies for various sites of prehistoric Europe, we would argue that the spatial duality of the mound ringed by the enclosure with four entrances and the single-layer settlement most likely expressed two different perceptions of time, a cyclical and a linear one (Bailey 1993; Biehl 2012, 141). We can thus assume the co-presence of two cognitive types of space/time systems regarding the internal ordering of the Polgár settlement. Following Henry Lefebvre, we can perhaps also contend that the sequence of activities was performed according to a certain rhythm in the context of the settlement’s different space/time structures and that the interplay of the cyclic (cosmic) and the linear (mechanic) rhythms created a singular ensemble and harmony distinctive to the world of that human habitat (Lefebvre 2004).

THE MICRO-REGIONAL, REGIONAL AND MACRO-REGIONAL NETWORKS OF POLGÁR-CSŐSZHALOM

The other main goal of our investigations at Polgár-Csőszhalom was to reconstruct the local and regional networks of the settlement complex based on previous work undertaken as part of the Upper Tisza Project (Chapman 1994; Magyari *et al.* 2012). The first, local scale was the natural palaeoecological environment in which the Polgár-Csőszhalom settlement was sited. The roughly 91 km² large late Pleistocene loess-covered elevation rising above the Tisza floodplain provided the environment in which the settlement’s occupants could engage in farming (Chapman 1994, 79–81 fig. 1–2; Sümegi *et al.* 2005). Complementing – and in a few instances correcting – the initial results of the Upper Tisza Project (Magyari *et al.* 2012, 281 fig. 2), we identified two additional tell-like settlements (Bosnyák-domb, Kígyós-domb) and seventeen small farmstead-like sites within a 5 km radius of Csőszhalom occupied between 5000 and 4500 BCE (Raczký *et al.* 2014; Füzesi *et al.* 2016; Raczký 2018, 16 fig. 1.1–2; Mesterházy *et al.* 2019, 6–7 fig. 3–4; Gyucha 2022, 64–66 fig. 5.4). A separate study was devoted to modelling the least-cost path network between the twenty Late Neolithic settlements on Polgár Island (Mesterházy *et al.* 2019, 7 fig. 4). The Polgár-Csőszhalom site and the smaller neighbouring settlements formed a settlement system resembling the one reconstructed in the Körös region within the framework of the Körös Regional Archaeological Project (Parkinson 2002; 2006; Gyucha *et al.* 2009; Duffy *et al.* 2013; Salisbury 2016) and in the adjacent Tiszazug micro-region

(Raczký and Füzesi 2016; Füzesi *et al.* 2020). The research projects all pointed in the same direction, both from an archaeological and a theoretical perspective: similarly, to other regions, the Late Neolithic settlement system of the Tisza region can only be meaningfully studied in a multi-scalar system (Neustupný 1998; Gyucha *et al.* 2009; Salisbury and Morris 2009; Parkinson and Gyucha 2012; Salisbury 2016; Parkinson *et al.* 2018).

On the macro-regional scale, the South-East European distribution of tell-type settlements can undoubtedly be linked to the spread of the Neolithic package towards Central Europe. Yet, even though the Early Neolithic farmers appearing in mainland Greece around 6600/6500 BCE advanced as far as the Drava-Maros line on the southern fringes of the Carpathian Basin by 6000 BCE, the first tell settlements only reached the same area in 5000 BCE (Schier 2005; Rosenstock 2009; Müller 2015; Raczký 2019; Gyucha *et al.* 2022). This would suggest that although there was a definite association between the new Neolithic subsistence strategies and tells as a distinct monumental form of expressing group identity, they nevertheless operated in different space/time reference systems as constructed by community attitudes. Expanding existence in a world anchored in the horizontal sphere tells created a vertical dimension to sedentary space that was strongly linked to the antecedents of a habitational place, constructing thereby the physical and cognitive framework of 3D spatiality (Chapman 1989;

Evans 2003, 112–115; Raczky 2019; Gyucha 2022). Additionally, the title of one of Ian Hodder's studies on Neolithic houses, "From Diffusion to Structural Transformation. The Changing Roles of the Neolithic

House in the Middle East, Turkey and Europe" (Hodder 2013), can in general also be applied to settlement mounds as forms of built structures.

NEW ADVANCES IN THE RESEARCH OF LATE NEOLITHIC TELLS AND SINGLE-LAYER SETTLEMENTS IN THE TISZA REGION

In the light of the above we may assert that the scholarly perception of Neolithic tells dominating prehistoric studies in the 1980s and 1990s was fundamentally altered in the wake of more recent research results and the new methodological advances. This is most eloquently illustrated by the fact that a narrative of the history of the Late Neolithic in the Tisza region can no longer be based on a few remarkable tell settlements and that the previous argumentations incorporated into grand narratives no longer hold up (Souvatzi 2020). This was the main consideration that inspired us to map as many Neolithic tells and special settlements using GIS, archaeological prospection and geoarchaeological surveys, as well as to revisit previously investigated sites in order to gain a more accurate picture of their representativity in the light of a greatly enhanced knowledge of the settlement network and settlement patterns. Our approach adopted the research logic represented by the inductive or bottom-up method (Wunderlich *et al.* 2023, 14–17). This corresponds to the epistemological hierarchic model in which the analysis leads from the realities of a small local world and its data through the scales of low-level and middle-range theory to the scale of grand theory (Smith 2015, 21–23 fig. 3). A similar methodological framework has been introduced and accepted for the study of the Bronze Age tells of the Carpathian Basin (*e.g.* Staniuk *et al.* 2020).

Building on the insights gained from the previous investigations of Polgár-Csőszhalom, our primary and minimal goal from 2018 onwards was to revisit the five tell and tell-like settlements that acted as the main sources of information in the 1980s–1990s and to study the finer details of their spatial organisation and their place in the settlement network using complex geophysical surveys in order to determine their micro-regional role. In undertaking this research project, we were generously assisted by Eszter Bánffy and Knut Rassman, and we thus partnered with the Romano-Germanic Commission of the German Archaeological Institute (RGK-DAI). We also received much-appreciated help from the Foundation for the Study and Preservation of Tells in the Prehistoric Old World (FSPT) directed by Thomas Kienlin for the magnetometer survey of Berettyóújfalu-Herpály. Simultaneously with our research project, William Parkinson, Roderick Salisbury and Attila Gyucha

undertook the magnetometer survey and complex investigation of several Late Neolithic settlements in the Körös region as part of the Hungarian-American Körös Regional Archaeological Project (KRAP). The results of the intensive investigation of various other Late Neolithic sites across the entire Tisza region were available from published reports, which, taken together, provided a good snapshot of the work on individual sites. Our study follows the approach taken by Robert Hofmann and his colleagues in their synthesis (Hofmann *et al.* 2019). By publishing recent results in this field, we hope to contribute to a future narrative on settlement history at a greater scale employing a bottom-up approach (Chapman 2020; Gyucha *et al.* 2022; Gyucha 2022).

On the testimony of the current record, information is available on the spatial structure of eighteen Late Neolithic settlements along the Tisza and in the Körös region in eastern Hungary, in the area extending from Gönc-Kenderföld in the north to Tápé-Lebő in the south (Table 1, Fig. 4). A rich diversity of spatial organisation can be discerned in the layout of these settlements (Fig. 5–6). The prominent structures include ditches, burnt houses and a stratified habitation space, all of which are recurrent elements. At the same time, the spatial organisation, occasionally taking the form of a regular geometric layout, differs from one site to the next. Two settlements, Gönc-Kenderföld and Szolnok-Tűzköves are extensive single-layer sites with elements of various macro-features and both represent what William Parkinson has termed the "supersite" settlement type (Parkinson 2006, 141–143). The remaining sixteen sites all have a tell or tell-like architectural module embedded in a complex spatial organisation and all played a prominent role as the focal point of the settlement clusters around them, the single exception being Csárdaszállás, site 26, with its small tell-like mound ringed by a single ditch, where there were one to four houses at the most (Salisbury *et al.* 2013). On the testimony of the magnetometer surveys, Hódmezővásárhely-Gorzsa, Vésztő-Mágor and Tápé-Lebő were three settlements with a stand-alone habitation mound bounded by a ditched enclosure, but lacking a single-layer settlement. Other sites, such as Berettyóújfalu-Szilhalom, Szentpéterszeg-Kovadomb, Polgár-Bosnyákdomb, Hódmezővásárhely-Kökénydomb

Table 1. Selected archaeological and GIS information on the eighteen Late Neolithic sites of the Tisza region surveyed using magnetometry (Table: Gábor Mesterházy, Karin Winter).

No	Site	Tell	Tell-like s.	Single-layer s.	Enclosure	Burnt houses	Unburnt houses	Latitude	Longitude	Size total (ha)	Size tell and tell-like (ha)	References
1	Gönc-Kenderföldek			x	Lengyel-type			48.477	21.284	0.65		Hajdu and Kiss 2023
2	Polgár-Csőszhalom	x		x	Lengyel-type	x	x	47.871	21.157	67.50	0.48	Mesterházy <i>et al.</i> 2019
3	Polgár-Bosnyákdomb		x	x	x	x		47.839	21.092	>3.00	0.56	Raczky and Anders 2009b
4	Hajdúböszörmény-Pród	x		x	Lengyel-type			47.744	21.341	un-known	0.38	Raczky <i>et al.</i> 2010
5	Szolnok-Tűzköves			x	x		x	47.218	20.194	~11.30		Unpublished
6	Berettyóújfalu-Szilhalom	x		x	x	x		47.222	21.513	>2.00	0.30	Neumann <i>et al.</i> 2014
7	Berettyóújfalu-Herpály	x		x	x	x		47.240	21.577	~15.00	0.30	Unpublished
8	Szentpéterszeg-Kovadomb	x		x	x	x		47.239	21.626	>1.50	0.60	Raczky and Anders 2014
9	Vésztő-Mágor	x			x	x		46.940	21.209		2.69	Gyucha <i>et al.</i> 2015
10	Szeghalom-Kovácschalom	x		x	x	x	x	46.989	21.155	>90.00	0.90	Gyucha <i>et al.</i> 2015
11	Csárdaszállás 26		x		x		x	46.892	20.908		0.50	Salisbury <i>et al.</i> 2013
12	Csökmő-Káposztás-domb	x		x	x	x		47.027	21.265	~90.00	0.49	Riebe <i>et al.</i> 2023
13	Öcsöd-Kováshalom		x		x	x	x	46.879	20.328	88.00	0.79	Füzesi <i>et al.</i> 2020
14	Szegvár-Tűzköves	x		x	x	x	x	46.599	20.262	31.00	5.46	Raczky <i>et al.</i> 2025
15	Hódmezővásárhely-Kökénydomb		x	x	concentric	x		46.338	20.296	6.50	0.69	Raczky <i>et al.</i> 2022
16	Hódmezővásárhely-Gorzsa	x			x	x		46.320	20.287		4.00	Unpublished
17	Tápé-Lebő	horiz. expand. (A-B)			x	x		46.272	20.279		1.33 + 2.20	Unpublished
18	Battonya-Parázs tanya	x		x	x	x		46.353	20.972	>21.10	1.48	Győri <i>et al.</i> in press

and probably Hajdúböszörmény-Pródi-halom, were characterised by a smaller tell or tell-like mound and a few hectares large single-layer settlement. Settlements with a complex spatial organisation covering several dozen hectares can be found in the Maros region (Battonya-Parázs-tanya), the Körös region (Berettyóújfalu-Herpály, Szeghalom-Kovácschalom, Csökmő-Káposztás-domb) and in the Tisza region (Szegevár-Tűzköves, Öcsöd-Kováshalom, Polgár-Csőszhalom). In addition to the tell or tell-like module, the single other shared element of the surveyed sites was their location on a higher elevation near water.

NEW PERSPECTIVES OFFERED BY THE RESULTS OF RECENT SETTLEMENT ARCHAEOLOGY STUDIES FOR THE CARPATHIAN BASIN

One point that emerges clearly from the data and the site plans yielded by the geophysical surveys (Fig. 5–6) is that the previously established categories of tell settlements, tell-like settlements and single-layer horizontal settlements of the Late Neolithic on the Alföld that were previously regarded as clearly distinct categories have by now been superseded (Kalicz and Raczký 1987, 14–16; Kalicz and Raczký 1990, 16–20; Link 2006, 10–14). It would appear that the decisive role was played by a single dimension in the universal structuring principle thought to be valid for the entire Tisza

region: the thickness of the superimposed occupation levels. Moreover, it also became clear that the categories of single-household sites, hamlets and villages based on horizontal extent existed side-by-side and formed dynamically changing formations through fusion and fission, and that these too can have superimposed occupation layers (Chapman 2008; Duffy *et al.* 2013; Salisbury 2016, 53–56). In this perspective, a settlement unit encapsulated a complex system pulsating both horizontally and vertically at its own distinctive “frequency”.

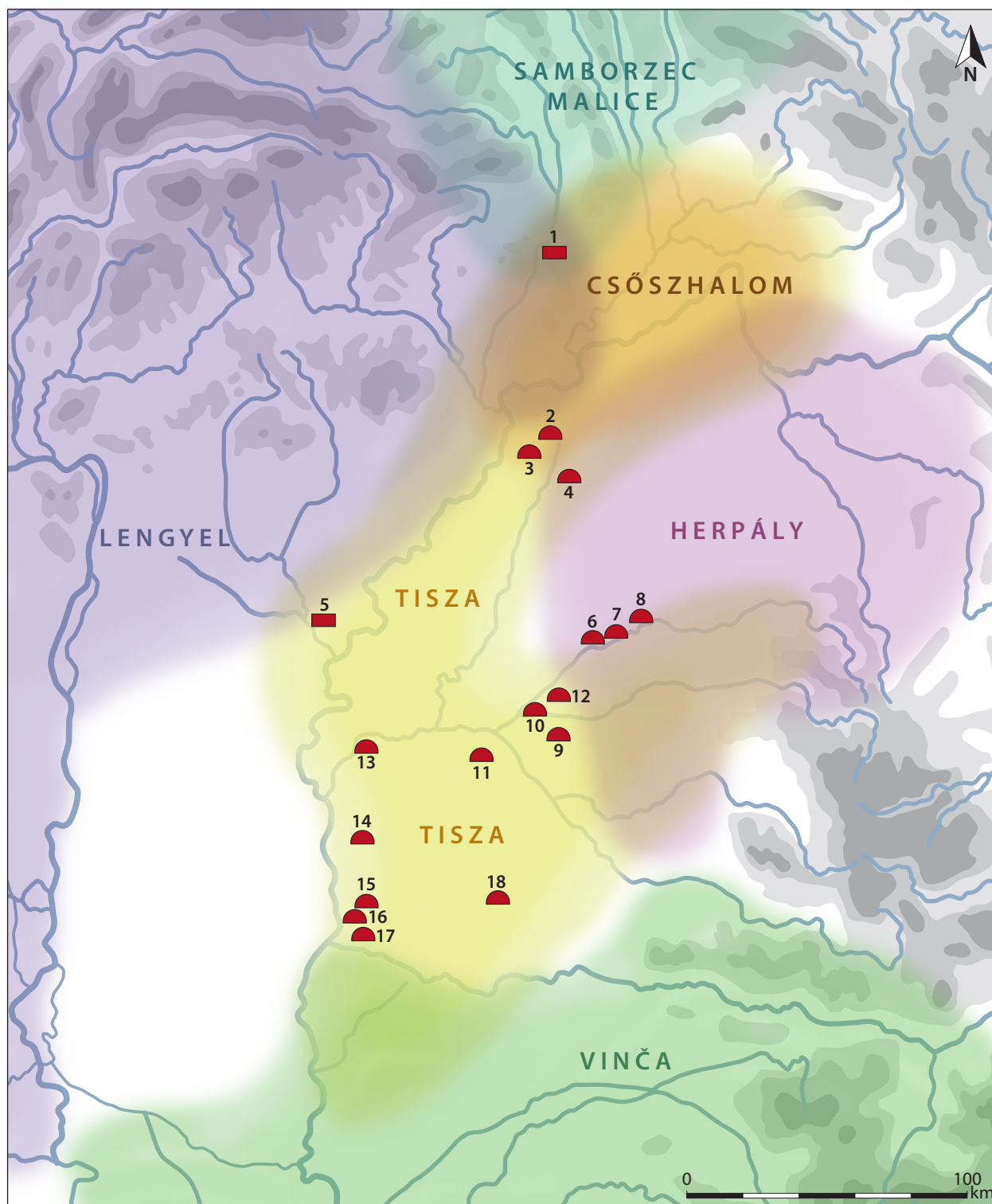
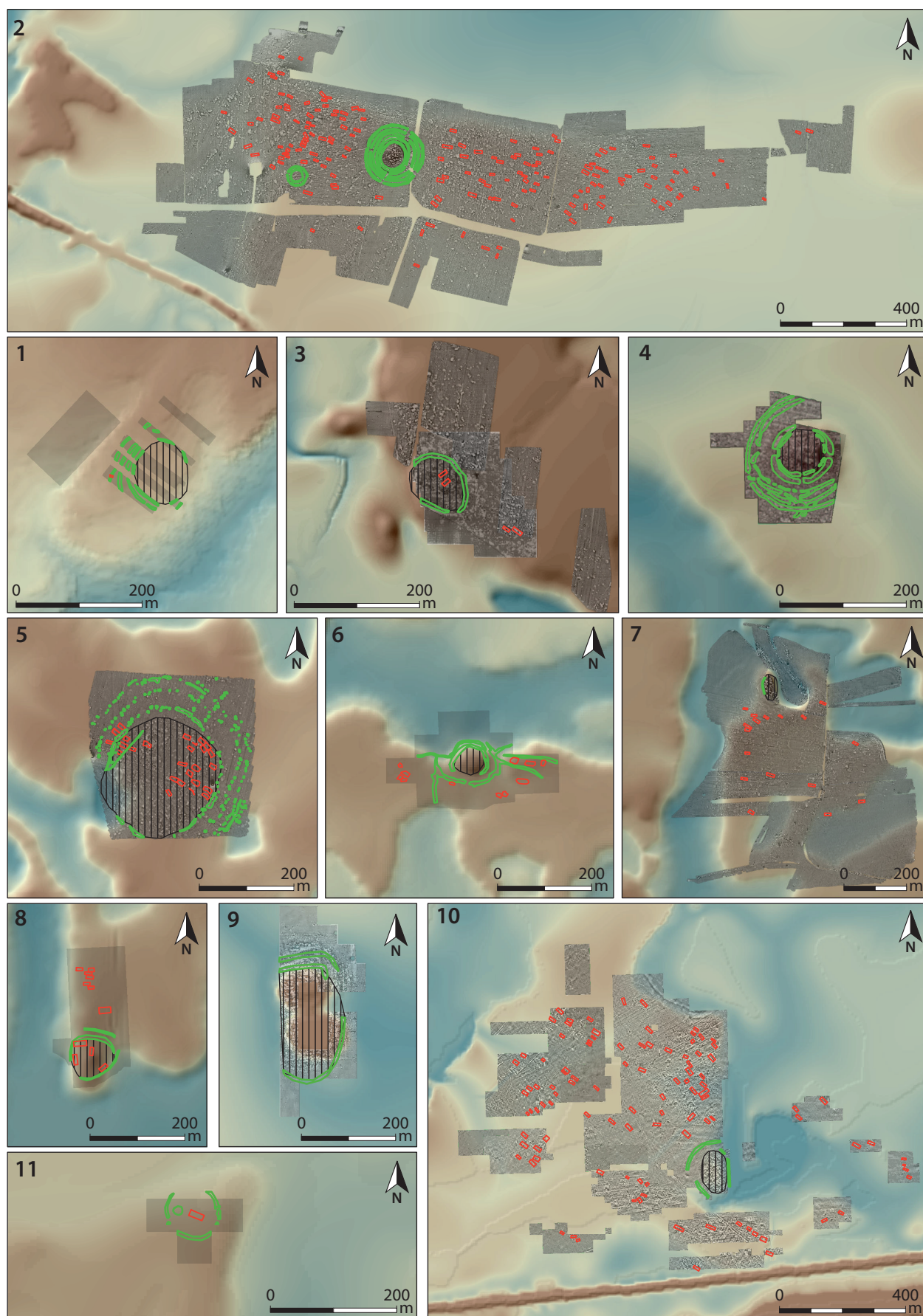


Fig. 4. The eighteen Late Neolithic settlements of the Tisza region for which magnetometric information is currently available. The previously reconstructed cultural regions of the Tisza-Herpály-Csőszhalom, the Lengyel, the Samborzec-Malice and the Vinča complex are also shown on the map. Single-layer settlements: 1. Gönc-Kenderföld, 5. Szolnok-Tűzköves. Habitation mounds: 2. Polgár-Csőszhalom, 3. Polgár-Bosnyákdomb, 4. Hajdúböszörmény-Pród, 6. Berettyóújfalu-Szilhalom, 7. Berettyóújfalu-Herpály, 8. Szentpéterszeg-Kovadomb, 9. Vésztő-Mágor, 10. Szeghalom-Kovácsalom, 11. Csárdaszállás 26, 12. Csökmő-Káposztás domb, 13. Öcsöd-Kováshalom, 14. Szegvár-Tűzköves, 15. Hódmezővásárhely-Kökénydomb, 16. Hódmezővásárhely-Gorzsa, 17. Táppé-Lebő, 18. Battonya-Parázs tanya (Graphic: András Füzesi).



The “built to unbuilt space ratio” and the “sizes of tells and flat sites” proposed by John Chapman (Chapman 1989, 38–39 fig. 2; 2020, 204 fig. 6.7a) is now generally accepted as a significant element of the dimensional order of Late Neolithic settlements. It also foregrounds the significant role played by social dynamics in structuring space and the striking diversity of physical manifestations, while at the same time highlighting that the previously proposed classification system of settlements (Makkay 1982, 104–164) cannot be correlated with particular categories of social organisations on a one-to-one basis (Strahm 1995). A similar methodological caveat is that the role of Late Neolithic tells and extensive single-layer settlements as fixed points in a landscape does not automatically translate into an important social role at a regional scale or even identical roles (Parkinson 2006; Link 2009, 100; Müller 2010; Hofmann 2012; Salisbury 2016, 81–85).

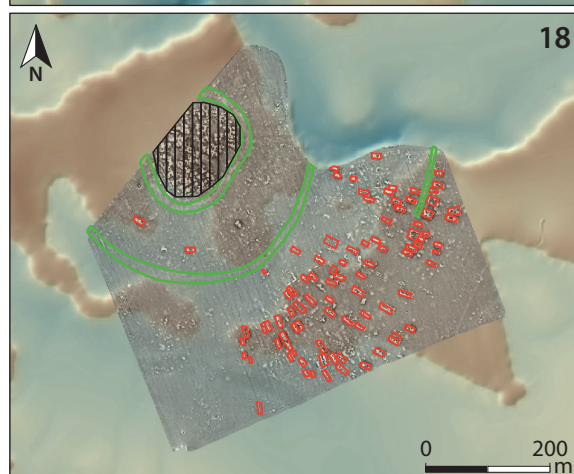
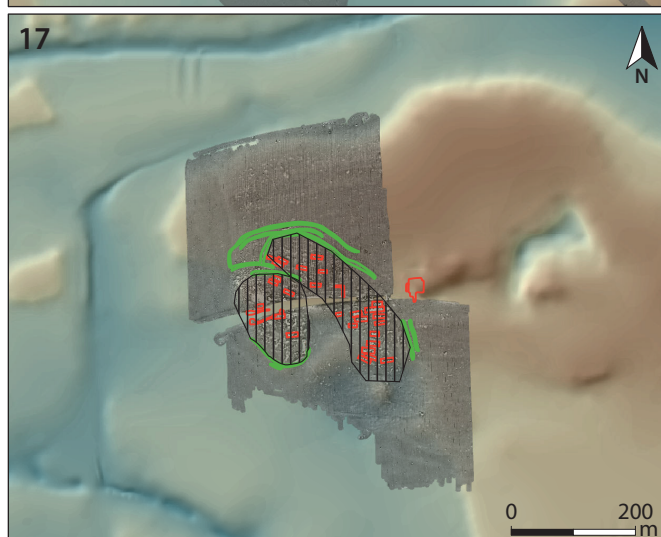
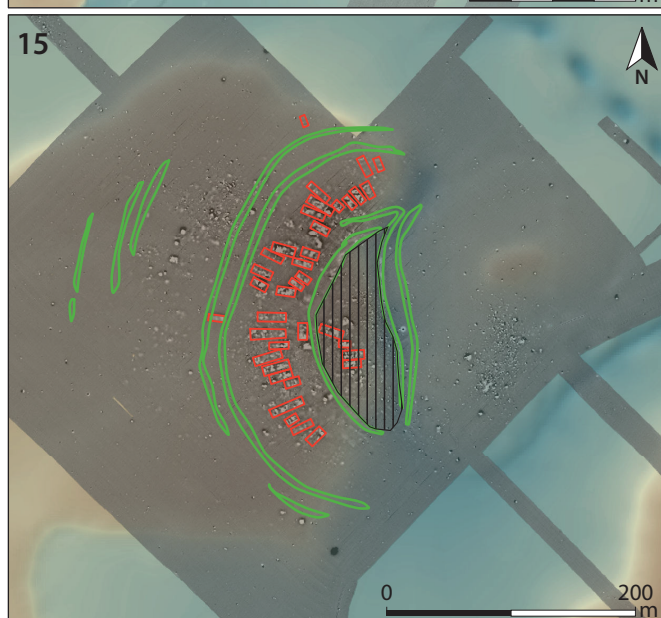
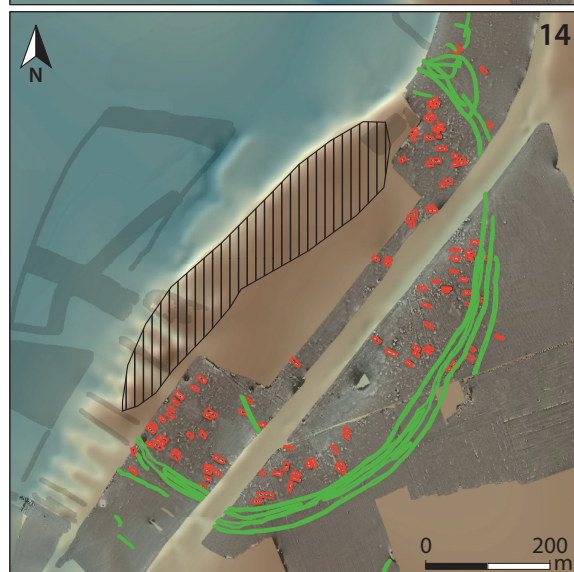
The differential physical associations of the one-time spatial organisation as reconstructed for Polgár-Csőszhalom (see Fig. 2.4) represented an elaborate system and the same holds true for the associated social interactions. In the case of the latter, complexity was often understood as a hierarchic system, while possible heterarchy was rarely considered (Turchin *et al.* 2017, 148–149); a similar conceptual problem has been noted in the case of Bronze Age tells (Kienlin 2020, 182–185). Based on his review of the archaeological record, Marko Porčić has convincingly argued that there is no evidence whatsoever for the emergence of even a rudimentary social stratification in the Balkans between 6500 and 4200 BCE (Porčić 2019), which seems to be valid for the Neolithic population establishing the central settlements on the Alföld, too.

A closer look at the spatial organisation of the eighteen Late Neolithic settlements of the Tisza region reveals that no two are the same, each had its own unique pattern and represented individual configurations of settlement components. This point is perhaps best illustrated Hódmezővásárhely-Kökénydomb and Hódmezővásárhely-Gorzsa, two settlements lying a mere 2.2 km apart: the Kökénydomb tell lay on the waterfront and was ringed by a single-layer settlement structured into zones with circular enclosures,

with the houses of both spatial segments aligned radially (Fig. 6.14). In contrast, at Gorzsa we documented a tell bounded by a ditched enclosure and burnt houses arranged linearly, with no traces whatsoever of a single-layer settlement (Fig. 6.15). Despite their proximity, two entirely different forms of monumental community “architecture” were created in the arena of local social configuration. Another example of local community identities materialising in individually generated, singular physical forms is the marked divergence of the ornamental vocabulary of the decorated pottery from Kökénydomb and Gorzsa, which has since long puzzled archaeological scholarship. The divergence between the ceramic assemblages from the two sites was variously attributed to the cultural differences between the Tisza culture and the Gorzsa group or to their differing chronological position (*e.g.* Bognár-Kutzián 1966; Horváth 2005), which in itself illustrates the fallibility of the definition of cultures based exclusively on pottery forms and ornamentation. The bottom-up approach employed in our investigations quite naturally dictated that the boundaries of the large Tisza-Herpály-Csőszhalom cultural region determined according to the distribution of ceramic attributes as well as their spatial structures be reassessed within the framework of a polythetic cultural model (Furholt 2020, 4–5 fig. 2; Clarke 1968, 35–37).

In sum, the geomagnetic survey of the eighteen Late Neolithic settlements of the Tisza region and the field observations made during previous investigations suggest that the structure of these settlements was generally characterised by contingency – in other words, the spatial modules – the graves, ditched enclosures, settlement mounds and houses arranged in geometric formations – formed complex systems through the highly individual variations of the basic categories of a shared architectural vocabulary, behind which we can assume different practices and communities with different make-up. Thus, the monumental idiom of the Late Neolithic in the Tisza region was essentially determined by the structures made up of habitation mounds (tells), circular enclosures and houses arranged into geometric patterns and their many different associations.

Fig. 5. (left page). The spatial structures of Late Neolithic settlements as interpreted from magnetograms. 1 Gönc-Káposztásdomb; 2 Polgár-Csőszhalom; 3 Polgár-Bosnyákdomb; 4 Hajdúböszörmény-Pród; 5 Szolnok-Tűzköves; 6 Berettyóújfalu-Szilhalom; 7 Berettyóújfalu-Herpály; 8 Szentpéterszeg-Kovadomb; 9 Vésztő-Mágor; 10 Szeghalom-Kovácsdomb; 11 Csárdaszállás 26 (Graphic: Gábor Mesterházy).



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Fig. 6. (left page). The spatial structures of Late Neolithic settlements as interpreted from magnetograms. 12 Csökmő-Káposztás domb; 13 Ócsöd-Kováshalom; 14 Szegvár-Tűzköves; 15 Hódmezővásárhely-Kökénydomb; 16 Hódmezővásárhely-Gorzsza; 17 Táppé-Lebő; 18 Battonya-Parázs tanya (Graphic: Gábor Mesterházy).

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Pollen, Spores, Charcoal, and the Beginning of Agriculture in East Westphalia

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KEYWORDS: Warburger Börde, non-pollen palynomorphs (NPP), game, neolithisation

Abstract

Today's Warburger Börde is characterised by settlements, farms and crop fields. This cultural landscape has developed through agricultural activity from a former densely wooded natural landscape. Palynological analyses of the peat of the Körbecker Bruch show the formation of different forest types with the warming of the climate after the beginning of the Holocene, and deforestation by humans that began with Neolithic

agriculture about seven millennia ago. Presumably, the activities of Early Neolithic farmers already reduced the density of wild animals, which could have posed problems for contemporaneous Mesolithic groups that relied on hunting. The results from the Warburg Börde are consistent with neighbouring regions and contribute to our understanding of the Early Neolithic transformation in Central Europe.

Zusammenfassung

Die heutige Warburger Börde wird durch Siedlungen, Bauernhöfe und Getreidefelder geprägt. Diese Kulturlandschaft hat sich durch landwirtschaftliche Tätigkeit aus seiner dicht bewaldeten Naturlandschaft entwickelt. So zeigen palynologische Analysen der Torfe des Körbecker Bruch mit der Klimaerwärmung nach Beginn des Holozäns die Ausbildung verschiedener Waldtypen, und die mit der neolithischen Landwirtschaft vor etwa sieben Jahrtausenden beginnende Entwaldung durch den

Menschen. Vermutlich verringerte sich schon durch die Aktivitäten der frühen neolithischen Menschen die Wildtierdichte, was die zeitgleich existierenden mesolithischen Gruppen, die auf die Jagd angewiesen waren, vor Probleme gestellt haben könnte. Die Ergebnisse aus der Warburger Börde stehen im Einklang mit benachbarten Regionen, und tragen zu unserem Verständnis der frühneolithischen Transformation Mitteleuropas bei.

POLLEN, SPORES, CHARCOAL, AND THE BEGINNING OF AGRICULTURE IN EAST WESTPHALIA

A walk through the Warburg Börde today reveals a landscape comprising settlements, farmsteads, cereal fields and farmland. This cultural landscape (Fig. 1) is characterised by the long-standing practices of arable farming and livestock breeding. However, it is of interest to consider what the landscape may have looked like prior to human intervention, whereby the natural landscape was remodelled to suit human needs and ideas. As evidenced by current research, the cultivation of cereals in East Westphalia commenced some 7000 years ago (Freund 1994; Schlütz 1997; 2025). No written records from this period have been preserved. However, other kinds of archives contain information about

the changes to the landscape. In the Warburg Börde, these are predominantly peat deposits that formed as fens along various streams. In these fens, which are emblematic of the Börde landscape and are called "Bruch", the peat deposits can reach several metres in thickness. This is exemplified by the Rösebecker Bruch (Wohlfahrt 2002) and the Körbecker Bruch (Singer 2016). The formation of organic deposits commenced thousands of years ago with the silting up of shallow waters and persisted for an extended period. An initial phase of lake formation was soon followed by the formation of peat. As the deposits grew, pollen grains from the surrounding vegetation were also placed in



Abb. 1. View from the Körbecker Bruch to the landmark of the Warburger Börde, the Desenberg. In the foreground, a dense stand of cuckoo flower (*Lychnis flos-cuculi*) (Photo: Frank Grawe).

them at all times. Under high microscopic magnification (500x–1200x), pollen grains can exhibit considerable variation, reflecting the diversity of plant species from which they originate. When drilling cores from such archives are analysed layer by layer, as is done in the course of palynological analyses, the changing composition of the pollen and spore content provides information about the landscape change over time.

Palynological analyses are only available to a limited extent for the Warburger Börde. The peat from the Rösebecker Bruch does not permit any inferences to be drawn regarding the landscape at the inception of arable farming, due to its chronological position (Wohlfahrt 2002). However, this period has been preserved in the Körbecker Bruch. A very basic palynological diagram (Fig. 2) was constructed based on initial analysis (Singer 2016) of a core taken in 2015 (Fig. 3). The palynological record of vegetation change commences a few centuries after the onset of the Holocene, the warm period that persists to the present day. The tree-hostile cold period of the Pleistocene was only some centuries ago, and the early forests are dominated by pines and some birch (Fig. 2, diagram section 1). As the climate became more favourable, deciduous trees like oak, lime,

elm and alder began to spread (section 2). Subsequently, humans initiated the process of deforestation for the establishment of settlements and agricultural practices. They cultivated cereals in the fields, and hazel bushes and birch trees became more prevalent in the opened forests (section 3). The ^{14}C -dating indicates that agriculture began at the Körbecker Bruch around 4500 BCE, making it somewhat younger than the early settlements at Borgentreich-Großeneder (Pollmann 2012; 2015; Jürgens 2019), which are approximately 10 km away. The find that farming in the Warburg Börde did not begin simultaneously in all parts can be undoubtedly attributable to the initially low population density. This aligns with the assumption that humans only engaged in agricultural activities within the immediate vicinity of their settlements. It seems plausible to suggest that the initial arable farming near the Körbecker Bruch originated from a yet unknown close by settlement. There is a possibility that the anthropogenic indicators are connected to the late Rössen Culture and the following Michelsberg Culture, whose population constructed a number of earthworks in the Warburg Börde, like that at Borgentreich-Bühne (Jürgens und Pollmann 2014; Jürgens 2016).

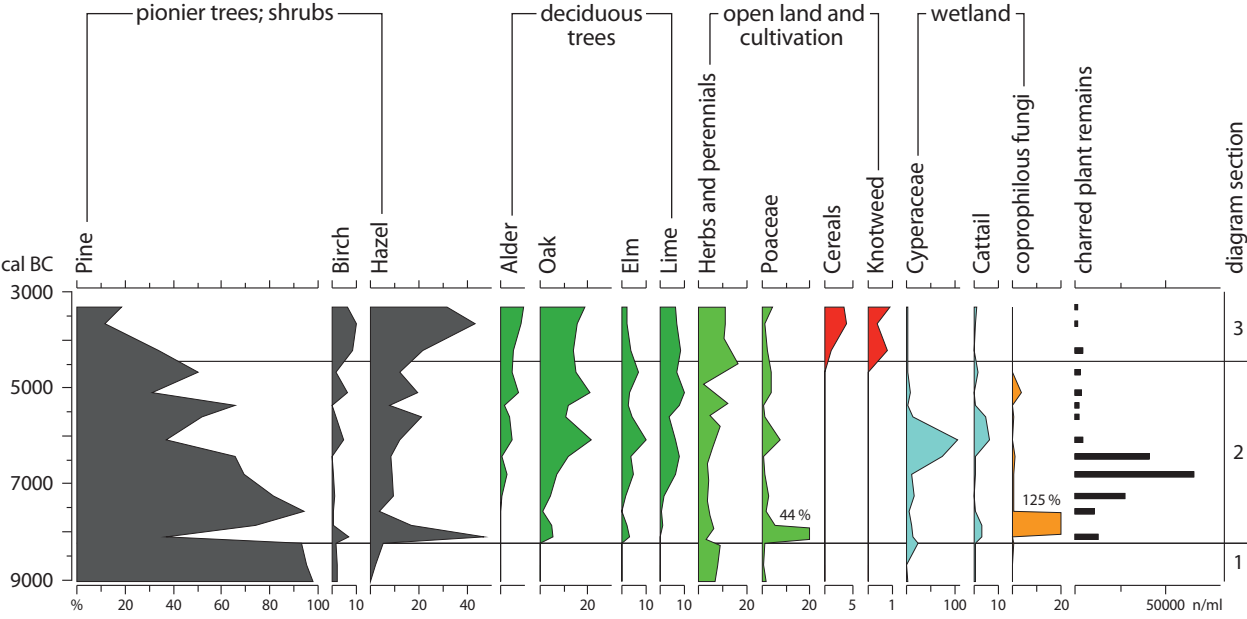


Abb. 2. Pollen and spore diagram of a drilling core from the Körbecker Bruch (51° 33' 3.053" N, 9° 15' 23.501" E). The percentages of all curves refer to the sum of the tree pollen grains of the respective samples (tree pollen = 100 %). The concentration is given for the charred plant particles. The ages are based on radiocarbon dating of plant remains (see Singer 2016; graphic: Frank Schlütz).



Abb. 3. During a student internship in the Körbecker Bruch, the investigated peat core was extracted using a Russian chamber driller (Photo: Lyudmila Shumilovskikh).

While the Neolithic Revolution led to a reduction in the dependence of people on natural food resources by crop cultivation and animal husbandry, there were nevertheless groups of people whose Mesolithic way of life remained heavily reliant on hunting. With the advent of the detection of cereals and tread-resistant plants such as bird knotweed (*Polygonum aviculare*-type), the finds of spores of so-called dung or coprophilous fungi decrease (transition section 2 to section 3). Such coprophilous fungi flourish particularly on the dung of larger herbivores. It seems plausible to suggest that wild animals were once relatively abundant in the Körbecker Bruch, but that their numbers subsequently declined with the onset of the Neolithic period. For those groups of people who continue in their Mesolithic tradition and economy (Heinen *et al.* 2015), it may have become increasingly challenging to source suitable game as a result of the expansion of Neolithic economy. The high numbers of charred plant remains in section 2 can be interpreted as the result of Mesolithic hunting fires.

Seen from the pollen of cereals and knotweed agriculture and livestock farming are transforming the landscape in the Warburg Börde for thousands of years. But when did arable farming begin in the rest

of East Westphalia? Pollen diagrams from the Weserbergland and neighbouring regions provide us with information on this. While cereal pollen grains are not found in areas with poor soils until around the middle of the 4th millennium BCE, it can be assumed that the Neolithisation in other regions with loess soils began just as early as in the Warburg Börde. There is corresponding palynological evidence from the Detmold area, but there is a lack of ¹⁴C-datings for a reliable chronological classification (Pott 1985; Freund 1994).

The beginning of the Neolithic economy in the Weser valley near Corvey (Höxter), which can be related to the Michelsberg Culture, is probably somewhat younger than in the Warburg Börde (Schlütz 1997). In the neighbouring mountain regions of the Egge and the Solling, the first pollen-analytical evidence of agriculture also dates back to the Neolithic as well (Trautmann 1957; Jahns 2005; Schlütz 2025).

Apparently, our results from the Körbecker Bruch are part of a whole group of corresponding evidence of a very early phase of Neolithisation. They provide important information on the early Neolithic landscape transformation leading to the today cultural landscape of the Warburger Börde.

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The Long Transitional Phase – Trends and Transitions in Animal Husbandry and Lifestyle 4800–3300 cal BC in the Oldenburger Graben Region, Eastern Holstein (Northern Germany)

Ulrich Schmölcke, Daniel Groß

KEYWORDS: Neolithic transition, Ertebølle Culture, Funnel Beaker Culture, cultural coexistence, transformation

Abstract

Our paper explores the transformation from forager societies to agricultural communities in North Central Europe, focusing on the Oldenburger Graben in Germany. This region provides unique archaeological and ecological insights from the Late Mesolithic to the end of the regional Neolithic. The Oldenburger Graben, shaped by the Littorina Transgression, had fjord-like bays that provided rich marine resources. The gradual shift from brackish to freshwater conditions altered human subsistence patterns. Foragers of the Ertebølle culture maintained a largely sedentary lifestyle along the coast, utilising fish, sea mammals, and wild game such as red deer and boar. The presence of imported tools and pottery indicates early cultural interactions with farming communities. The long Neolithic transition, starting at c. 4100 BCE, was marked by the arrival of farmers from the south, bringing domesticated

animals and crops. However, rather than a sudden shift, data suggests a long co-existence of foraging and farming for over a millennium. Sites like Neustadt and Wangels illustrate early interactions, where some adopted farming practices while others retained traditional subsistence. Initially, wild game remained a dominant resource, with domestic livestock (cattle, sheep, pigs) playing a minor role. Over time, livestock husbandry expanded, particularly in the Middle Neolithic. However, new analyses suggest that hunting, particularly of aurochs, continued significantly longer than previously assumed. The Oldenburger Graben exemplifies a gradual and complex Neolithic transition, challenging the notion of an agricultural “revolution”. Despite extensive research, further studies on animal remains are needed to fully understand the economic and social changes.

Zusammenfassung

Unser Beitrag untersucht den Wandel von Forager-Gesellschaften zu landwirtschaftlichen Gemeinschaften in Nordmitteleuropa und konzentriert sich dabei auf den Oldenburger Graben in Deutschland. Diese Region bietet einzigartige archäologische und ökologische Einblicke vom späten Mesolithikum bis zum Ende des regionalen Neolithikums. Der Oldenburger Graben, der durch die Littorina-Transgression geformt wurde, hatte fjordartige Buchten, die reiche Meeresressourcen boten. Der allmähliche Übergang von Brack- zu Süßwasserbedingungen veränderte die menschlichen Subsistenzmuster. Die Jäger der Ertebølle-Kultur lebten weitgehend sesshaft an der Küste und ernährten sich von Fischen, Meeressäugtieren und Wild wie Rotwild und Wildschwein. Das Vorhandensein von importierten Werkzeugen und Töpferwaren weist auf frühe kulturelle Interaktionen mit bäuerlichen Gemeinschaften hin. Der

lange Übergang zum Neolithikum (ab ca. 4100 v. Chr.) war durch die Ankunft von Bauern aus dem Süden gekennzeichnet, die domestizierte Tiere und Feldfrüchte mitbrachten. Die Daten deuten jedoch nicht auf einen plötzlichen Wandel hin, sondern auf eine lange Koexistenz von Forager- und bäuerlichem Lebensstil über mehr als ein Jahrtausend hinweg. Fundplätze wie Neustadt und Wangels veranschaulichen frühe Interaktionen, bei denen einige Forager landwirtschaftliche Praktiken anwandten, während andere ihre traditionelle Lebensweise beibehielten. Anfänglich blieb Wild eine dominierende Ressource, während die Nutztiere (Rinder, Schafe, Schweine) eine untergeordnete Rolle spielten. Im Laufe der Zeit weitete sich die Viehhaltung aus, insbesondere im Mittelneolithikum. Neue Analysen deuten jedoch darauf hin, dass die Jagd, insbesondere auf den Aurochs, länger bedeutend blieb als bisher

angenommen. Der Oldenburger Graben ist ein Beispiel für einen allmählichen und komplexen neolithischen Übergang, der die Vorstellung von einer landwirtschaftlichen „Revolution“ in Frage stellt. Trotz umfangreicher

Forschungen sind weitere Studien an Tierresten erforderlich, um die wirtschaftlichen und sozialen Veränderungen vollständig zu verstehen.

INTRODUCTION

The general course of the transformation from forager societies to farming and the change of human subsistence in the course of the subsequent Neolithic has long been investigated for north-central Europe (e.g. Benecke 1994; Lüning 2000) and is still being studied intensively (e.g. Sørensen and Karg 2014; Hinz 2018). It is particularly interesting to examine the entire development in a small geographical area as this can provide more detailed insights into the actual transformations that happened. In Germany the Grube-Wessek lowland (also called “*Oldenburger Graben*”) in

Ostholstein provides the best continuous insights into the development of human lifeways, so far, but also into ecological changes, and animal use from the Late Mesolithic to the end of the Neolithic (4800–1800 cal BC). Given new finds, methods, and approaches — which stem not least from research projects initiated and co-designed by Johannes Müller — it is worth looking at what is currently known about the transformation phase and the course of the Neolithic in this region. In doing so, we will focus on the significance of animal farming, fishing, and hunting.

MESOREGION OLDENBURGER GRABEN

For the history of Stone Age culture and landscape, the lowland Oldenburger Graben is one of the best-investigated regions in northern central Europe. With a length of 20 km and a width of between 200 m and 4 km, it crosses the Wagrien peninsula from the Hohnow Bay in the west to the Lübeck Bay in the east. The cause of the special character of this landscape is the ingress of the Baltic Sea that occurred during the Littorina Transgression and the resulting inundation of the landscape from the west as well as the east between 5300 and 5100 cal BC (Jakobsen 2004). In the following centuries, two elongated narrow bays were formed, creating an exceptionally favourable habitat for humans: here, they exploited marine resources without being exposed to the open sea. The number, distribution, and size of Stone Age sites suggest a high population density in contrast to the hinterland (Fig. 1).

The two fjord-like bays reached their maximum extension between 3600 and 3000 cal BC (Jakobsen 2004), afterwards the end of the rapid sea level rise and the associated consolidation of the coast ended the marine phase of the Oldenburger Graben. From 3000 cal BC, barriers repeatedly blocked the mouth of the western bay, which, interrupted by occasional storm tides, resulted in its gradual desalination and silting-up. The

marine/freshwater transition in the western bay of the Oldenburger Graben occurred 2800/2700 cal BC (Feesser and Dörfler 2019). In the eastern bay, this development was more delayed; marine conditions can still be detected there until after 2000 cal BC. According to pollen analyses, the final sealing of the eastern bay from the Baltic Sea only took place at the beginning of the last millennium BCE, i.e. during the Bronze Age (Venus 2004).

The waterlogged conditions resulting from this very special genesis of this landscape led to outstanding preservation conditions for organic archaeological material and make the Grube-Wessek lowland an important archive for ecologic, economic, and social developments, a ‘Treasure Chest of the Stone Age’ (Hartz 2017). Consequently, results from this region have been used for the definition of chronologies of the late Ertebølle and early Funnel Beaker Cultures (Hartz and Lübke 2006; Hartz 2005).

Significant numbers of well-preserved remains of vertebrates were discovered at many Stone Age sites in the Grube-Wessek lowland, not least because in many cases Stone Age refuse zones were selected for archaeological excavations. Much of the archaeozoological work has already been published or presented. Rosenfelde LA 83¹ (Hartz *et al.* 2014; Schmütz 2014)

1 Rosenfelde LA 83 is the oldest late site in the Oldenburger Graben area. Visited repeatedly between 5300 and 4800 cal BC and belonging to the aceramic Ertebølle

phase, it was a special site used for (eel) fishing and fish processing.

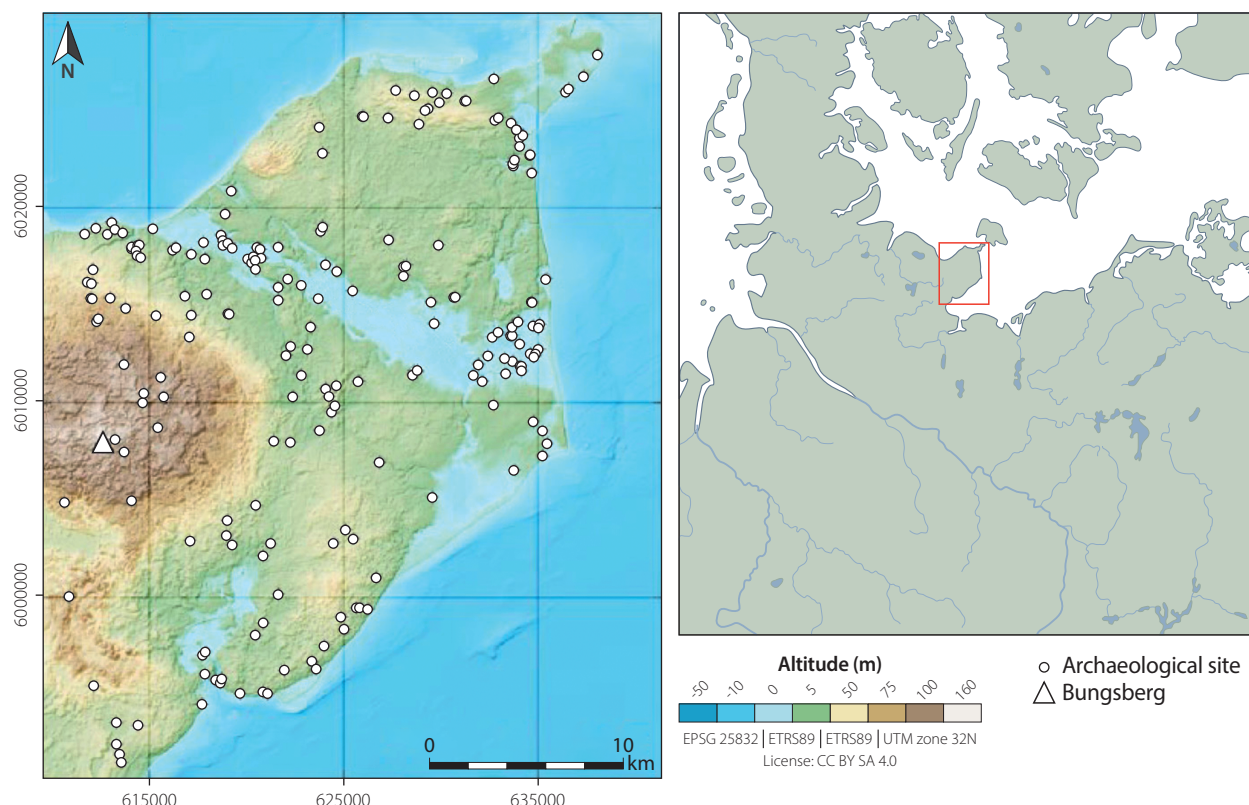


Fig. 1. Location of the Oldenburger Graben in northern Germany with Stone Age sites. The left map (from Knitter *et al.* 2019, 1573 fig. 1) shows the maximum extent of the two fjord-like bays, which are now silted up (Right map: Karin Winter).

and Rosenhof LA 58 (Nobis 1975; Hartz *et al.* 2014, on individual aspects Breede 2003; Scheu *et al.* 2008; Goldhammer 2008; Ewersen 2008; Brendel 2025) were occupied during the late Ertebølle period; in addition, there is the nearby final Ertebølle site Neustadt LA 156 which shows signs of early Neolithic influences (Glykou 2014; 2016; 2020). Wangels LA 505 (Heinrich 1997/98) and Siggeneben Süd (Grube LA 12; Heinrich 1997/98) show Early Neolithic layers, the Middle

Neolithic was discovered at Dannau LA 191 (Matthey 2005), Heringsdorf-Süssau (Nobis 1971), at Wangels LA 505 (Schmölcke 2001), and at Oldenburg LA 232 (Brozio *et al.* 2019). Finally, the Late Neolithic is represented in Oldenburg LA 265 (Schmölcke 2021). That means the Oldenburger Graben offers the possibility to investigate the development of hunting practices and animal husbandry over a very long period on a regional level.

SEDENTARY COASTLINE FORAGERS

In the middle of the sixth millennium BCE, farming societies spread from the Balkans to Central Europe, and by 5200 cal BC, they had rapidly opened up vast areas up to the fertile loess landscapes off the northern edge of the Central European low mountain ranges (Gronenborn 1999; Hofmann 2022). They brought cattle, sheep, goats, and pigs as well as crops such as emmer, einkorn, lentil, pea, and flax. At the same time, the brackish fjords and lagoons north of the Elbe river, provided optimal human habitats — and that is why the regional hunter-fisher-gatherers of the Ertebølle Culture could develop a largely stationary settlement system. They lived sedentarily at coastal residential

sites exploiting additionally the inland resources for seasonal hunting and gathering (Fischer 2007). As a result, a stable distribution of coastal-orientated s in the north and farmers in the south persisted in northern Germany for about 1500 years.

Grube-Rosenhof LA 58 and Neustadt LA 156 were such residential sites with an almost year-round occupation. At Rosenhof, located at a peninsula in the eastern fjord, the occupation started around 4900 cal BC. At about 4600 cal BC the first pottery and T-shaped antler axes were introduced (Goldhammer 2008). Towards the end of the occupation period, the finds became fewer and the site was abandoned about

Table 1. Number of morphologically identified mammal remains (NISP) from Grube-Rosenhof LA 58 (4900–4200 cal BC) and Neustadt LA 156 (4400–3800 cal BC), sorted by the proportions in the Rosenhof total assemblage. The animal remains from the older excavation campaigns at Rosenhof were identified by Dirk Heinrich. Data from Neustadt are published by Aikaterini Glykou (2016). At Rosenhof, it is very likely that both the bones identified as *Bos primigenius* (f. *taurus*?) and as the domesticated form *Bos primigenius* f. *taurus* are small female aurochs. According to current knowledge, it is just as likely that at both sites no domestic pigs were kept. The bones in question could originate from feral animals or small wild female specimens. The *Ovis*/*Capra* determinations also need generally to be verified and dated.

	Grube-Rosenhof LA 58 excavations						Neustadt LA 156	
	1969–1980		2001/2002		All totalled			
	NISP (n)	NISP (%)	NISP (n)	NISP (%)	NISP (n)	NISP (%)	NISP (n)	NISP (%)
Red deer (<i>Cervus elaphus</i>)	566	32.1	113	37.5	679	33.0	798	27.8
Wild boar (<i>Sus scrofa</i>)	443	25.1	56	18.6	499	24.3	521	18.1
Pig? (<i>Sus scrofa</i> f. domestica?)	(62)		(10)					
Pig (<i>Sus scrofa</i> f. domestica)	(3)		(1)					
Roe deer (<i>Capreolus capreolus</i>)	223	12.7	27	9.0	250	12.2	242	8.4
Seals (Phocidae)	197	11.2	12	4.0	209	10.2	292	10.2
<i>Pagophilus groenlandicus</i>	(30)							
<i>Halichoerus grypus</i>	(14)		(5)					
<i>Pusa hispida</i>	(5)							
Aurochs (<i>Bos primigenius</i>)	186	10.6	29	9.6	209	10.2	369	12.8
Cattle or aurochs	(100)		(7)					
Cattle (<i>Bos primigenius</i> f. taurus)	(33)		(6)					
Dog (<i>Canis lupus</i> f. familiaris)	55	3.1	6	2.0	61	3.0	237	8.2
Elk (<i>Alces alces</i>)	44	2.5			44	2.1	54	1.9
Otter (<i>Lutra lutra</i>)	1	0.1	27	9.0	28	1.4	68	2.4
Pine marten (<i>Martes martes</i>)	4	0.2	20	6.6	24	1.2	19	0.7
Brown bear (<i>Ursus arctos</i>)	11	0.6			11	0.5	1	0.0
Wild horse (<i>Equus ferus</i>)	7	0.4	2	0.7	9	0.4	1	0.0
Mices (<i>Apodemus</i> sp.)			8	2.7	8	0.4	1	0.0
<i>Apodemus flavicollis</i>			(3)					
Wild cat (<i>Felis silvestris</i>)	7	0.4			7	0.3	12	0.4
Harbour porpoise (<i>Phocoena phocoena</i>)	5	0.3	1	0.3	6	0.3	137	4.8
Badger (<i>Meles meles</i>)	4	0.2			4	0.2	7	0.2
Sheep or goat (<i>Ovis/Capra</i>)	3	0.2			3	0.1	12	0.4
Beaver (<i>Castor fiber</i>)	2	0.1			2	0.1	24	0.8
Lynx (<i>Lynx lynx</i>)	1	0.1			1	0.0	3	0.1
Brown hare (<i>Lepus europaeus</i>)	1	0.1			1	0.0		
Delphinidae	1	0.1			1	0.0	3	0.1
Common dolphin (<i>Delphinus delphis</i>)								
Voles (Arvicolinae)	1	0.1			1	0.0	37	1.2
Water vole (<i>Arvicola amphibius</i>)	(1)				(1)		(33)	
Bank vole (<i>Myodes glareolus</i>)							(3)	
Field vole (<i>Microtus agrestis</i>)							(1)	
Hedgehog (<i>Erinaceus europaeus</i>)							20	0.7
Wolfe (<i>Canis lupus</i>)							7	0.2
Red fox (<i>Vulpes vulpes</i>)							6	0.2
Polecat (<i>Mustela putorius</i>)							3	0.1
Total	1762	100.0	301	100.0	2057	100.0	2874	100.0

4200 cal BC at the latest (*ibid.*, 43).² A range of wooden fish-catching devices but also paddles, sea mammal remains and several thousands of fish bones show the relevance of aquatic resources. A perforated Danubian shoe-last axe with a partially preserved handle of limewood, directly dated to 4855–4787 cal BC (1 sigma; KIA-15031; Hartz 2005, 67), confirms the early presence of foreign, “imported” goods. Already first excavations in the 1970s produced a significant assemblage of animal remains, but so far, only an outdated preliminary study some these finds has been published (Nobis 1975). Here we present for the first time a full species list from the excavation in the 1970s, compiled by Dirk Heinrich (formerly Kiel University), and compare them to the finds of the excavation in 2001/2 published by Sönke Hartz *et al.* (2014) (Table 1). Red deer and wild boar were the most important prey (together 57 percent). Aurochs, the significantly smaller roe deer, and various seal species accounted for over 10 percent of the finds. It is highly likely that the hunters worked closely together with trained dogs (Schmölcke 2023), and dogs are the only domestic animal species that can be reliably detected in the assemblage. There is no clear evidence of the presence of livestock animals.

Single questionable or controversial bones of *Sus* and *Bos* likely origin from feral individuals or their descendants (Krause-Kyora *et al.* 2013; Rowley-Conwy and Zeder 2014; Caliebe *et al.* 2017) or revealed no evidence for those aDNA haplotypes, which are characteristically for cattle (Scheu *et al.* 2008). The only exception is a scapula genetically assigned to cattle, but it postdates the main use phase of the site. Nevertheless, with an age of 4029–3986 cal BC (1 sigma; KIA-28210), it is the second oldest cattle bone in the region after a slightly older find from Neustadt (Table 2).

Probably, all other bovid bones from Rosenhof with unclear morphological classification belong to small female, wild aurochs specimens. This applies also to other alleged domestics from further coastal stations from mid of the 5th millennium BCE (Sørensen and Karg 2014; Schmölcke and Nikulina 2015). From a zoological point of view, the records of Dalmatian Pelican (*Pelecanus crispus*; Nikulina and Schmölcke 2015), wild horse (*Equus ferus*; Sommer *et al.* 2011) and lynx (*Lynx lynx*) are of special interest. The pelican — a unique find for northern Germany — fits in a series of Danish records and points to a breeding colony in the western Baltic Sea area during the fifth millennium BCE. The

Table 2. Directly radiocarbon-dated bones of domestic animals from archaeological sites in the Oldenburger Graben area.

Species	Bone	Site	Lab. no.	BP	Cal BC		Reference
					1 sigma	2 sigma	
<i>Sus scrofa</i> (f. domestica?)	mandible	Rosenhof LA 58	AAR-4996	5800±25	4707–4651	4719–4581	Krause-Kyora <i>et al.</i> 2013
<i>Ovis/Capra</i>	metapodium	Wangels LA 505	KIA-7127	5325±45	4135–4055	4260–4044	Hartz and Lübke 2006
<i>Ovis/Capra</i>	metapodium	Wangels LA 505	KIA-7129	5295±35	4167–4094	4241–4042	Hartz and Lübke 2006
<i>Bos primigenius</i> f. taurus	humerus	Neustadt LA 156	KIA-30590	5235±31	4051–3984	4069–3968	Craig <i>et al.</i> 2011
<i>Bos primigenius</i> f. taurus	scapula	Rosenhof LA 58	KIA-28210	5231±25	4029–3986	4059–3971	Scheu <i>et al.</i> 2008
<i>Ovis/Capra</i>	skull	Neustadt LA 156	KIA-29091	5214±32	4045–4007	4162–4134	Craig <i>et al.</i> 2011
<i>Bos primigenius</i> f. taurus	metatarsus	Wangels LA 505	AAR-4998	5165±45	4000–3947	4052–3912	Scheu <i>et al.</i> 2008
<i>Ovis/Capra</i>	phalanx I	Rosenhof LA 58	AAR-1459	5110±90	3988–3789	4058–3697	Hartz <i>et al.</i> 2000
<i>Ovis/Capra</i>	metacarpus	Wangels LA 505	KIA-7128	5085±35	3876–3804	3963–3794	Hartz and Lübke 2006
<i>Bos primigenius</i> f. taurus	talus	Neustadt LA 156	KIA-39767	5055±28	3944–3889	3952–3783	Craig <i>et al.</i> 2011
<i>Bos primigenius</i> f. taurus	tibia	Wangels LA 505	KIA-9824	5047±53	3945–3828	3961–3708	Hartz and Lübke 2006
<i>Ovis ammon</i> f. taurus	humerus	Neustadt LA 156	KIA-30591	5016±40	3937–3873	3947–3706	Craig <i>et al.</i> 2011
<i>Bos primigenius</i> f. taurus	metatarsus	Neustadt LA 156	KIA-29092	5010±34	3804–3753	3820–3704	Craig <i>et al.</i> 2011
<i>Bos primigenius</i> f. taurus	metacarpus	Rosenhof LA 58	AAR-4999	4910±50	3712–3640	3798–3630	Hartz and Lübke 2006
<i>Bos primigenius</i> f. taurus	tibia	Siggeneben-Süd	AAR-4995	4665±50	3479–3423	3533–3356	Hartz <i>et al.</i> 2000
<i>Bos primigenius</i> f. taurus		Siggeneben-Süd	AAR-4996	4630±50	3510–3428	3529–3330	Hartz <i>et al.</i> 2000
<i>Bos primigenius</i> f. taurus	radius	Rosenhof LA 58	AAR-1462	4410±75	3104–2916	3195–2903	Hartz <i>et al.</i> 2000
<i>Bos primigenius</i> f. taurus	metatarsus	Siggeneben-Süd	AAR-4997	4320±45	2936–2891	3030–2880	Noe-Nygaard <i>et al.</i> 2005

2 Older publications on Rosenhof assumed that the local occupation lasted until the transformation phase to the Neolithic, but there is no proven evidence of more than a sporadic human presence after 4200 cal BC. However,

people visited the place even thousand years later as a dated radius of a sheep demonstrate (1 sigma: 3104–2916 cal BC; AAR-1462; Hartz *et al.* 2000).

wild horse had disappeared from Central Europe and Scandinavia at the end of the early Holocene, and the Rosenhof finds are among the oldest remains that show a re-immigration at least into the coastal areas in the centuries after 4500 cal BC. Lynxes appeared in northernmost Central Europe in the late Boreal, as a Danish find from Zealand shows (Aaris-Sørensen 2009), and then appear to have been quite widespread from the mid and to the late Atlantic period. There are more than a dozen records from Denmark from this period (*ibid.*), and the species is documented twice from Late Mesolithic Schleswig-Holstein, not only from Rosenhof but also from Neustadt.

The coastal site Neustadt, located 25 km southwest from Rosenhof at a former lagoon, was occupied for over 600 years between 4400 and 3800 cal BC all year round. It almost seems as if Neustadt was the successor

to the abandoned Rosenhof site as the 's central location in the region. If small mammals (mice, voles, *etc.*) are disregarded, the proportions of the most important animal species are almost identical to Rosenhof (Table 1; Schmölcke 2023). Livestock animals are present, but extremely rare: cattle and sheep/goat only summarise up to 0.3% each. Three bones are archaeogenetically analysed, directly radiocarbon dated, and carry mitochondrial aDNA of domesticated cattle from the Near East (Scheu *et al.* 2008). One of them is the oldest verified cattle within an Ertebølle context so far, dating to 4051–3984 cal BC (1 sigma; KIA-30590); the other bones are from 3900/3800 cal BC (Table 2). Remarkable is an old small skull fragment morphologically identified as sheep or goat dated to 4045–4007 cal BC (1 sigma; KIA-29091) and thus one of the oldest ovicaprids remains in the north (Table 2).

THE LONG TRANSITIONAL PHASE

Both the human-genetic investigations (Skoglund *et al.* 2014; Malmström *et al.* 2015; Allentoft *et al.* 2024) and the archaeological-typological and archaeozoological findings indicate that around 4100 cal BC groups of livestock owners migrated from areas south of the Elbe to the north. In our study region, this is best reflected in the archaeological material from Neustadt (Glykou 2016). Archaeogenetic analyses of sheep bones prove that the immigration of the livestock owners and their domestic animals took place from the southwest (Nikulina and Schmölcke 2020). The immigrants developed immediate contacts with the autochthonous foragers, and at least in the cases of Neustadt and Wangels, they used the same settlements. However, there was no economic or technological revolution, nor was there any violent displacement of the original indigenous population by the new arrivals. Rather, a slow process began that lasted for centuries. s and their lifestyle survived during this transitional phase, as the “Lola” genome from the nearby Danish island Lolland (dated to 3799–3765 cal BC (1 sigma; 5007 ± 11 BP; GrM-13305; Jensen *et al.* 2019) and isotope signals from human skeletons prove (Fischer 2007). At some archaeological sites on the Danish and German Baltic Sea coast occupied in the following centuries, we observe such continuity from the late fifth to the early 4th millennium BCE that they are best interpreted as settlements of people with a more or less complete lifestyle (Lübke and Schmölcke 2010; Gron and Sørensen 2018; Fischer *et al.* 2021). At Lolland’s south coast, it is quite likely that both s and farmers lived nearby around the Syltholm Fjord (Rowley-Conwy 2023).

The site Wangels LA 505 represents the Early Neolithic Ia (4200–3800 BCE) period. At Wangels, dated to 4200–3880 cal BC and located on the shore of the western fjord, the time of farmers’ immigration into the Oldenburger Graben area is recorded. In contrast to the contemporaneous site Neustadt, the economy at Wangels from 4000 cal BC onwards focused already on livestock. About 50% of the identifiable mammal bones represent cattle, sheep/goats, and pigs (Heinrich 1997/1998). However, the identification of livestock bones is not always simple (Schmölcke and Groß 2020), and recent re-evaluations of sheep/goat remains from Swedish and Danish Early Neolithic sites show a high misidentification rate (Sjögren *et al.* 2023; Groß *et al.* 2024). The earliest livestock remains from the Oldenburger Graben therefore need to be checked with ZooMS-analyses or archaeogenetic methods, and this applies in particular to two bones from Wangels that are morphologically clearly identified as ovicaprids. They are regarded as the oldest evidence of livestock in the Oldenburger Graben but also far beyond. Both bones date concordantly to around 4100 cal BC (Table 2).

At Wangels grass-eating grazers like cattle and sheep/goat predominate the find ensemble, in contrast to pigs. This seems to be a general characteristic of the Early Neolithic Ia (Sørensen 2014; Sørensen and Karg 2014). Isotope data from cattle bones suggest animal keeping in man-made open areas on the countryside (Noe-Nygaard *et al.* 2005; Gron and Rowley-Conwy 2017). Signs for the use of woodlands as food resources for domestic animals are not recognisable in the isotope values (*ibid.*). This possibly indicates that the individual domestic animals were of such great value

that they were kept only near the settlement. The ‘endless mixed oak forest’ in the hinterland was probably considered too dangerous for the livestock, despite the possibility of grazing there.

Siggeneben-Süd (Grube LA 12), representing the following Early Neolithic Ib (3800–3500 BCE) period, is eponymous to a cultural phase, in which 90% of the pottery inventory consists of undecorated funnel beakers — the Funnel Beaker Culture has now fully emerged (Hartz and Lübke 2006). Similar to Wangels, the proportion of livestock animals still reaches approximately 50% of the identifiable mammal bones. Domestic pigs are now the most frequent group among livestock in the Siggeneben-Süd assemblage, and this result seems to be typical for this period in general (Sørensen 2014; Sørensen and Karg 2014). As a difference to the Early Neolithic Ia, cereal pollen was recorded in the Early Neolithic Ib. However, Ingo Feeser and Walter Dörfler (2019) assume that cereals still did not play an important economic role during Early Neolithic Ib. The two oldest finds of grains in the Oldenburg Graben date from this period. Nevertheless, from 3600 cal BC onwards, pollen data indicate an increased settlement and land-use activity, an opening of woodland associated with an increase in the light-demanding hazel *Corylus avellana* (Feeser and Dörfler 2019). The more prominent role of pigs fits very well in this context. The increasing land-use activity was connected to the period of monumental megalithic burials, which are characteristic of the following phase (Early

Neolithic II, 3500–3300 cal BC). Exactly during this period, the pollen values of *Plantago lanceolata* increase rapidly in the Oldenburger Graben area, indicating a transformed land use system with agricultural intensification (Feeser et al, 2012; Feeser and Dörfler 2019). Only now did the long period of transition from to farming societies with a duality of life concepts (Jensen and Sørensen 2023), come to an end.

Overall, the information available up to now indicates in any case that a “Neolithic lifestyle” cannot be assumed (for all social groups) in the coastal region during the first part of the transitional period (Early Neolithic Ia). Hunting wild animals, in particular red deer, still played a very important role for the people (e.g. Hartz and Schmölcke 2013). This applies in particular to coastal or lakeside sites like those in the Oldenburger Graben where bones of wild animals predominate by far (Sørensen 2014; Sørensen and Karg 2014). Unfortunately, due to the very limited remains of animals in terms of quantity and quality, the state of archaeozoological research on the Early Neolithic Ia in northern Germany and southern Scandinavia is insufficient: for instance, it is currently not possible to make reliable statements on priorities for the use of individual livestock species and/or their relation to wild and foraged resources. Overall, archaeozoology can therefore only provide very sketchy contributions to the earliest livestock husbandry in the north (Gron and Rowley-Conwy 2017). The Oldenburger Graben is no exception in this respect.

THE FURTHER COURSE

The further environmental, cultural, and social development of the Neolithic in the Oldenburger Graben area is known in detail thanks to the research of recent years, largely initiated by Johannes Müller (e.g. Mischka 2007; Hinz and Müller 2012 and papers therein; Brozio *et al.* 2014; Furholt 2014; Brozio 2016). Alas, this detail-rich knowledge does not apply to the development of animal husbandry, hunting, and human-animal relationships. There is definitively a need for further research in this respect.

New statistical analyses of Middle Neolithic bones from bovids show, for example, that numerous bones classified in the literature as “domestic cattle” apparently originate from aurochs — *i.e.* that hunting of large game increased much more than previously assumed, especially from Middle Neolithic II (from 3100 cal BC) onwards (Fig. 2). In this period, contemporaneous with the end of megalithic burials, we observe a kind of (agri-)cultural collapse, coinciding with climatic deterioration and the regeneration of woodland (Feeser *et al.* 2012; Feeser and Dörfler 2019).

However, the Oldenburger Graben area was still populated. The settlements Dannau LA 77 and Oldenburg LA 191, located directly next to each other at the western bay, have been particularly well studied (Brozio 2016; Weber *et al.* 2020). Unfortunately, their animal bone analyses are not yet adequately published. At least for Oldenburg the number of identified mammal remains can be presented here (Table 3). Both Dannau LA 77 and Oldenburg LA 191 show numbers of cattle dominating, followed by pigs. In the case of Oldenburg, sheep farming was of considerable economic importance, too. Because of an over-cautious assignment to the domesticated or wild form by the author (Matthey 2005), numerous bovid bones in Oldenburg have not been classified. Dimensional analyses show that the proportion of aurochs in the finds from Middle Neolithic settlements in the study area has been underestimated to date (Fig. 2), but this mostly concerns misidentifications in the somewhat younger Middle Neolithic III/IV settlement Süssau but not in Dannau and Oldenburg. Süssau was located at the eastern

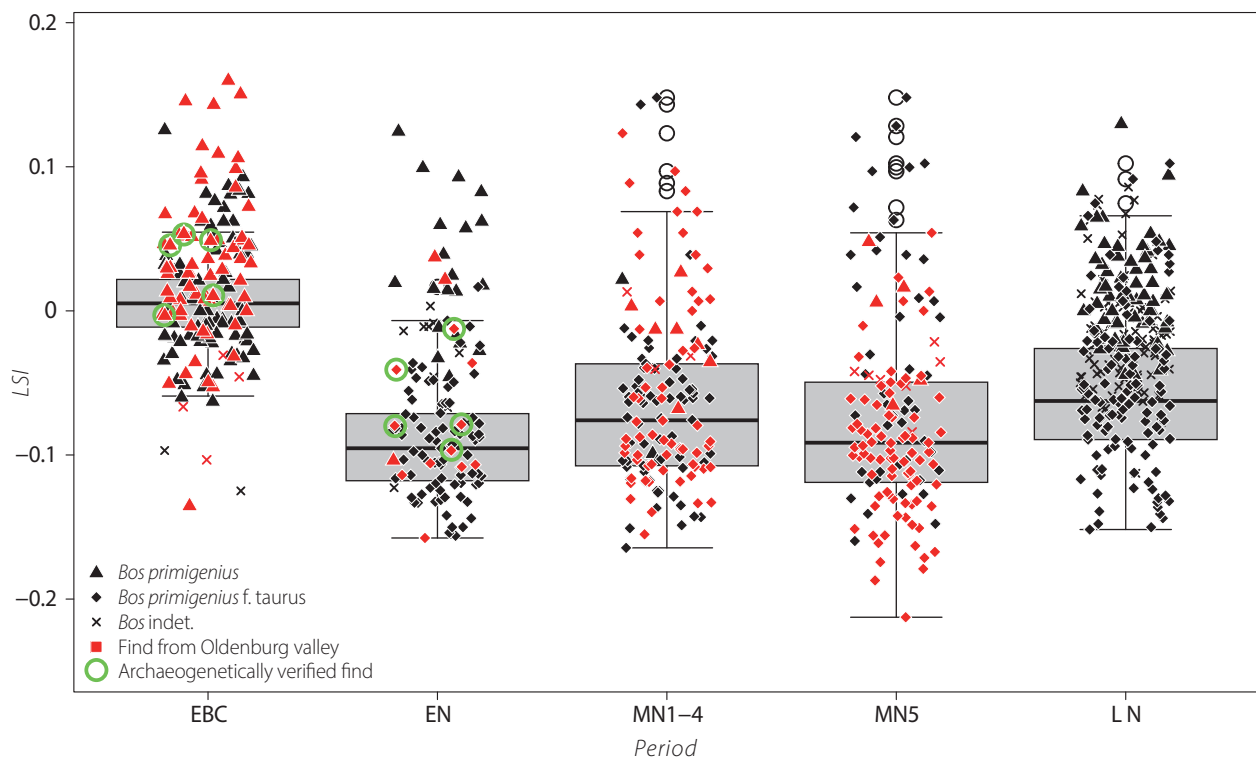


Fig. 2. Size development of bovids in the Oldenburger Graben (red) in comparison to Denmark and other parts of northern Germany (black). Archaeogenetically verified finds are marked in green. For the Ertebølle period (EBK) these are exclusively aurochs, for the Early Neolithic (FN) cattle. Given are the logarithmic size index (LSI) values for width. The individual measurements are plotted with a jitter of 0.2. The plot is ordered chronologically (MN 1-4: Middle Neolithic I–IV, MN 5: Middle Neolithic V, LN: Late Neolithic). The underlying data are published by Ulrich Schmölcke and Daniel Groß (2020).

bay and was more exposed to the Baltic Sea, as is also shown by high values of marine indicators both in pollen data (Feeser and Dörfler 2019) as in isotopic values (Ewersen and Schmölcke 2013).

From the beginning of the Middle Neolithic V, around 2900 cal BC, an economic recovery can be seen by inference from palynological data: open areas increased, but now agriculture is undertaken more variably and on smaller scales than before (Feeser *et al.* 2012). Not only does the first evidence of a cartwheel in northern central Europe fall into this time, found

in Danish Pilkmose and dendrochronologically dated to 2935 BCE (Christensen 2007), but also an increasing number of indirect indications for the regular and intensive use of cattle as draught animals begins (Johannsen 2006; Mischka 2011). It is yet likely that ox-carts were already longer known and used (also in the Oldenburger Graben), probably since 3390/3380 cal BC as traces of carts under a megalithic grave in Flintbek (Schleswig-Holstein) predate the Middle Neolithic V (Vosteen 1999; Mischka 2011).

CONCLUSION

In the Oldenburger Graben a series of well-preserved Stone Age settlement sites illustrate the transformation from to farmer communities during the first half of the fifth millennium BCE. As already indicated by Sönke Hartz *et al.* (2007), this region is witness to a long transformation process, a stepwise adoption of Neolithic subsistence. The farmers who immigrated around 4000 cal BC and settled in the immediate vicinity of the old centres near the Baltic Sea coast did by no means trigger a revolution; quite on the contrary,

long-lasting dualistic structures were established in which different economic systems were used simultaneously and in close proximity. Centuries passed before the subsistence was largely based on domestic animals, garden vegetables, and grain, and fishing was probably never abandoned, as the neighbouring Sylt-Holm Fjord illustrates (Koivisto *et al.* 2024). Despite all the work carried out in recent decades, the analysis of the animal remains recovered during the numerous excavations has not yet been completed. It is necessary

Table 3. Number of morphologically identified mammal remains (NISP) from Oldenburg-Dannau LA 191 (Middle Neolithic II) and Wangels LA 505 (Middle Neolithic V), sorted by the proportions in the Oldenburg total assemblage; animal remains from Oldenburg were analysed by Christiane Matthey (2005), preliminary data from Wangels published by Ulrich Schmölcke (2001).

	Oldenburg-Dannau LA 191 (MNII)		Wangels LA 505 MNV horizon	
	NISP (n)	NISP (%)	NISP (n)	NISP (%)
Domestic animals				
Cattle (<i>Bos primigenius</i> f. <i>taurus</i>)	505	40.3	450	57.0
Pig (<i>Sus scrofa</i> f. <i>domestica</i>)	431	34.3	246	31.1
Sheep and goat	313	24.9	62	7.8
Sheep (<i>Ovis ammon</i> f. <i>aries</i>)	(33)		(12)	
Goat (<i>Capra aegagrus</i> f. <i>hircus</i>)			(2)	
Dog (<i>Canis lupus</i> f. <i>familiaris</i>)	6	0.5	32	4.1
Total	1255	100.0	790	100.0
Domestic or wild				
<i>Bos</i>	300		93	
<i>Sus</i>	177		74	
<i>Canis</i> or <i>Vulpes</i>	1		2	
<i>Ovis</i> or <i>Capra</i> or <i>Capreolus</i>			1	
Total	478		170	
Hunted species				
Red deer (<i>Cervus elaphus</i>)	120	60.0	277	54.7
Aurochs (<i>Bos primigenius</i>)	30	15.0	28	5.5
Wild boar (<i>Sus scrofa</i>)	28	14.0	60	11.9
Roe deer (<i>Capreolus capreolus</i>)	11	5.5	72	14.2
Wild horse (<i>Equus ferus</i>)	3	1.5		
Seals (Phocidae)	2	1.0	30	5.9
Grey seal (<i>Halichoerus grypus</i>)	(1)		(4)	
Harp seal (<i>Pagophilus groenlandicus</i>)			(1)	
Ringed seal (<i>Pusa hispida</i>)			(5)	
Beaver (<i>Castor fiber</i>)	1	0.5	9	1.8
Wild cat (<i>Felis silvestris</i>)	1	0.5	4	0.8
Otter (<i>Lutra lutra</i>)	1	0.5	2	0.4
Moose (<i>Alces alces</i>)	1	0.5	1	0.2
Polecat (<i>Mustela putorius</i>)	1	0.5	1	0.2
Hare (<i>Lepus europaeus</i>)	1	0.5		
Wolf (<i>Canis lupus</i>)			7	1.4
Fox (<i>Vulpes vulpes</i>)			6	1.2
Badger (<i>Meles meles</i>)			4	0.8
Squirrel (<i>Sciurus vulgaris</i>)			3*	0.6
Pine marten (<i>Martes martes</i>)			2	0.4
Total	200	100.0	506	100.0

* A partial skeleton is counted as 1 specimen.

to present all the finds and apply new methods of investigation to old finds. It would be a great project to look at all the sites from Mesolithic sites Rosenfelde and Rosenhof to the Middle Neolithic settlement Wangels together. Perhaps such a project can be initiated in the near future. It would do justice to the “Oldenburg Graben treasure chest”.

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Small Settlements Near Jurassic Rock Formations Corded Ware Culture Hamlets in the Franconian Low Mountain Range

Timo Seregély

KEYWORDS: Corded Ware Culture, Final Neolithic, low mountain range, settlement, ritual site

Abstract

As part of a research project at the University of Bamberg on the Corded Ware Culture settlement of the North Franconian Jura, initiated by Johannes Müller during his time in Bamberg, the Corded Ware site of Wattendorf-Motzenstein was comprehensively investigated in an interdisciplinary manner between 2003 and 2006. In addition to the settlement structure of a few small log huts oriented along a path, a lot of information on the economy, environment and ritual activities of the Final Neolithic settlers could be gained. Within the framework of another project on ritual sites at rock formations, evidence of two more Corded Ware

settlements was discovered in 2008 and 2009. The features and finds from the sites “Hohler Stein” near Schwabthal and *Rothensteine* near Stübig will be summarised in this paper for the first time. Small Corded Ware hamlets in the immediate vicinity of Jurassic rocks were therefore not an exception, but apparently the rule in the region of the Northern Franconian Jura and the time around 2600 BCE. The imposing rock formations seem to have played an important role in the choice of settlement sites. It is possible that a connection between settlement and ritual sites was the main motive.

Zusammenfassung

Im Rahmen eines Forschungsprojekts der Universität Bamberg, welches von Johannes Müller während seiner Zeit in Bamberg zur schnurkeramischen Besiedlung der Nördlichen Frankenalb initiiert wurde, wurde der schnurkeramische Fundplatz Wattendorf-Motzenstein zwischen 2003 und 2006 interdisziplinär umfassend untersucht. Neben dem Nachweis der Siedlungsstruktur aus einigen kleinen Blockhütten, die sich entlang eines befestigten Weges befanden, wurden zahlreiche Informationen zu Wirtschaft, Umwelt und rituellen Aktivitäten der endneolithischen Siedlungsgemeinschaft gewonnen. Im Rahmen eines weiteren Projekts zu rituellen Plätzen an Felsformationen wurden 2008 und

2009 Hinweise auf zwei weitere Siedlungen der Schnurkeramik entdeckt. Die Befunde und Funde vom Hohlen Stein bei Schwabthal und den Rothensteinen bei Stübig werden in diesem Artikel erstmals zusammengefasst vorgestellt. Kleine, weilerartige Siedlungen der Schnurkeramik im direkten Umfeld auffälliger Jurafelsen waren daher keine Ausnahme, sondern in der Region der Nördlichen Frankenalb um 2600 v. Chr. offenbar charakteristisch. Die imposanten Felsformationen scheinen bei der Wahl des Siedlungsstandorts eine wichtige Rolle gespielt zu haben. Möglicherweise war das Hauptmotiv eine bewusste Verknüpfung von Siedlung und rituellem Platz.

Until two decades ago, settlements of the Corded Ware culture were completely unknown throughout Northeastern Bavaria. The image of this period was largely determined by single finds of axes and flint daggers or blades typical of the region. Only in exceptional cases were preserved graves containing characteristic grave goods, such as beakers, amphorae and stone and bone artefacts, documented (Hock 1933, 21–24; Hain 1976).

As part of my Master's thesis, I recorded all finds from the Final Neolithic and the beginning of the Early Bronze Age in Upper Franconia in order to gain information on the settlement history of this region in the 3rd millennium BCE (Seregély 2002; 2008a). In the course of this work, sherds of *Wellenleistenkeramik* (Cord Ware pots with 'short-wave moulding') were identified in the collection of the Historical Society of Bamberg, which had been wrongly dated to the Iron Age. They came from the Motzenstein site near Watendorf, a mighty dolomite rock measuring 30 x 25 m and about 10 m high, where they were found by a volunteer in the 1950s.

In 2003, on the initiative of Johannes Müller (then Bamberg, now Kiel), a research project was launched at the University of Bamberg, funded by the *Oberfrankenstiftung*. The project was intended to provide concrete evidence of Final Neolithic settlement on the landscape of the Northern Franconian Jura, characterised by conspicuous rock formations, with the Motzenstein site appearing to be a promising candidate. The excavations at this site extended over four campaigns (2003–2006) and as the results have been extensively presented in a monograph, an anthology and several papers (Müller and Seregély 2008a; Seregély 2008a; 2008c; Müller *et al.* 2009), a brief summary will suffice here. The outstanding feature in the centre of the plateau-like surface of the Motzenstein itself was a deposit of four grinding stones as well as a post-hole surrounded by dolomite stones (Seregély 2008a, 30 fig. 13–14). An interpretation of these finds as relics of a ritual site seems plausible due to their central location and rectangular shape. Perhaps the post hole was used to hold a post marking the site, while the grinding stones served as an altar-like area for depositing perishable food or drink offerings. Ultimately, however, this cannot be proven. A 2 m wide and up to 1.5 m deep rock hole on the northwestern slope of the dolomite rock produced further evidence of ceramic deposits, here especially from the Early Neolithic and the Iron Age (*ibid.*, 32 fig. 16). A pointed blade of Jurassic chert, however, also indicates deliberate deposition at this conspicuous site during the Final Neolithic (*ibid.*, 73 fig. 50). To the northwest of the rock, evidence of a small, hamlet-like settlement was found, which had been built on a gentle slope descending towards the

northeast (Fig. 1). The best-preserved settlement feature was a trapezoidal structure measuring approx. 8 x 5 m, dug slightly into the ground and filled in with several sediment layers (*ibid.*, 32–38). Due to the absence of post-holes, this probably consisted of a log hut with a sill beam construction. In the same, northwest-southeast orientation, there was a linear pavement of dolomite stones, about 1.0–1.5 m wide, which apparently served as a substructure for a path leading through the hamlet (*ibid.*, 35 fig. 19–20). Directly under the pavement, there were finds in several places that can be addressed as deposits, such as a trapezoidal, faceted axe made of amphibolite (*ibid.*, 77 fig. 54), four flint blades and a blade fragment (*ibid.*, 74 fig. 51) and a complete miniature axe made of clay (*ibid.*, 62 fig. 47). Moreover, partly deepened structures along the path indicate at least four contemporaneous log huts, which formed the hamlet-like settlement (Seregély 2008b, 13–15 fig. 2–5). Almost all of the settlement pottery consisted of decorated vessel fragments, whereby pots were mainly decorated with 'short-wave moulding' or other plastic elements (Seregély 2008a, 41–60). Amphorae, on the other hand, were also decorated with scratches, cord impressions, stitches and, above all, incised line bundles. In the case of beakers, combined cord and stitch decoration dominated in some cases, with *Wickelschnur* techniques appearing towards the end of the settlement period at Motzenstein. The pottery analyses revealed a variance in clay composition, which makes the presence of a single specialised pottery workshop seem implausible (Daszkiewicz *et al.* 2008). The variance can perhaps be explained by household related pottery production as well as potters marrying in from surrounding settlements (Müller and Seregély 2008b, 181). Furthermore, few complete or mostly fragmented clay miniatures of axes and wheels were found in the settlement area. Several aspects, *e.g.* the depositing character of the complete pieces underneath the path substructure or in the corner of a hut, the regular fragmentation of the other pieces and the lack of traces of use on the cutting edges and hammer ends of the axes as well as on the outside of the wheel models, rather point to an interpretation as ritually used objects (Seregély 2008a, 62–72; 2008b, 20–21). An association with children would be conceivable here, but not in a primary function as a toy but in the context of initiation rites. Sandstones, which were used for abrasive and polishing tools, were, apart from a few pieces, procured within a radius of max. 15 km, whereby the exceptions already point to an important long-distance trade route in the direction of Eastern Bohemia (Scharff 2008; Müller and Seregély 2008b, 185 fig. 5). It is also very probable that the raw material *Aktinolith-Hornblende-Schist* for the axes produced at Motzenstein came



Fig. 1. Johannes Müller (right) and the author at the settlement site Wattendorf-Motzenstein (trench in one of the log hut sites) in spring 2004 (Photo: Alexa Dürr).

from the rock quarrying area of Jistebsko (Christensen and Schüssler 2008). In addition to the many polishing stones made of fine-grained Dogger-Beta sandstone, numerous drill cores, rock debris, blanks and semi-finished tools testify to a lively production of weapons and working tools at Motzenstein (Seregély 2008a, 77–81; 2008b, 29–30 table 2–3). In contrast, a different picture emerges with regard to the used silices (Mischka 2008; Seregély 2008a, 73–77). In addition to the predominantly used local Jurassic chert of poor quality, the presence of Jurassic chert with better impact properties from Middle Franconia and chert of the Baiersdorf and Abensberg-Arnhofen type suggests a trade route leading south-southeast via the Middle and Southeastern Franconian Jura (Müller and Seregély 2008a, 185 fig. 5). Since flakes of these better-quality materials are missing, it is most likely that finished tools were imported.

Much information has also been obtained on the use of domestic and wild animals (Becker 2008). The shares were 64% for domestic animals and 36% for wild animals. As expected, cattle dominated the former, but the rather high proportion of horses is interesting. In the case of hunted animals, red deer was the

most important species, but species untypical for this landscape region, such as elk and beaver, were also represented. Thus, the hunting radius almost certainly extended to the Main Valley, about 15 km away. Only a few preserved macro remains were available for indications of crop cultivation, but they could, however, be supplemented by grain and husk imprints on pottery fragments (Kroll 2008). According to this, the Corded Ware settlers at Motzenstein cultivated barley, *Emmer* and *Einkorn*. In addition to the numerous grinding tools found in the settlement area and the ritually interpretable setting of grinding stones on the rock plateau, studies on the geomorphological development of the neighbouring dry valley assign an important role to cereal cultivation (Fuchs *et al.* 2008). According to this, the first colluvium formation, which filled the dry valley floor, began around the middle of the 3rd millennium BCE. This proves an intensive agricultural use of the valley slopes at the time of the Corded Ware settlement at Motzenstein. A series of ¹⁴C-dates points to a focus of Final Neolithic settlement activity between 2630 and 2570 BCE, although these 50 years reflect only a minimum settlement period (Seregély 2008a, 91–95; 2008b, 19–20).



Fig. 2. Hohler Stein near Schwabthal. Left: Map of the site with the rock formation in grey and trenches (2–20) and contour map of the site (brown = high, yellow = low); right: view from the northwest (Photo: Timo Seregély).

Another project funded by the *Oberfrankenstiftung* was carried out together with Frank Falkenstein (University of Würzburg) from 2008–2010. It aimed directly at the diachronic, ritual use of conspicuous rock formations in the area of the Northern Franconian Jura during prehistory (Falkenstein 2012). Two of the six investigated sites provided evidence for Corded Ware settlement activities. At the site Hohler Stein near Schwabthal (Fig. 2), research excavations in 2008 yielded a wealth of highly interesting results, ranging from an Early Neolithic ritual site to an unusual Hallstatt burial site (Seregély and Link 2009; Hendel 2012; Noack 2012). In addition, several Corded Ware pottery finds were recovered in the trenches directly on the rock, including a faceted amphibolite chisel in trench 3 and several pottery fragments in trench 19. On the eastern edge of trench 4 and the western edge of trench 18, several fragments of a beaker decorated with cord impressions and a stitch decorated rim were recovered, which was probably deposited in a shattered and incomplete state (Fig. 3). The loess, which dried out much faster at the position of the beaker sherd concentration, indicated that the soil there has been dug up during the Final Neolithic. Apart from these, only Early Neolithic remains were found in this level. Finally, only about 20 m north of the rock, sparse remains of a Corded Ware settlement were discovered in trench 9. The situation, with the upper slope facing east and the distance from the base of the rock, is strikingly similar to that at Motzenstein near Wattendorf. However, the preservation of the features was much worse than at Motzenstein, with many features almost completely eroded. Only 0.2 m below the ground, which is now used as a meadow, a



Fig. 3. Hohler Stein near Schwabthal. Corded Ware beaker sherds of trenches 4 and 18 (Photo: Gertraud Gerner).

dense accumulation of dolomite stones was documented, in the area of which Final Neolithic finds were clearly concentrated (Fig. 4). The only deeper feature was a northwest-southeast oriented longitudinal pit, only 0.5 m wide and 1.0 m long. This was still preserved to a depth of about 40 cm and contained fragments of burnt clay and charcoal, possibly the remains of a hearth. The extent of the dolomite pebbles suggests a rectangular, northeast-southwest oriented hut site measuring about 5 x 4 m. After the original loess cover had been removed for other purposes, the stones were probably used as a substructure, similar to the path found at Motzenstein. The inner floor of the hut probably consisted of a wooden beam, which was protected from moisture by the stones. Towards the northwest, a narrower concentration of dolomite stones, about 1 m wide, adjoins, although it remains unclear whether this could also be a substructure for a path. If so, it would connect directly to the house site and make an entrance situation on the

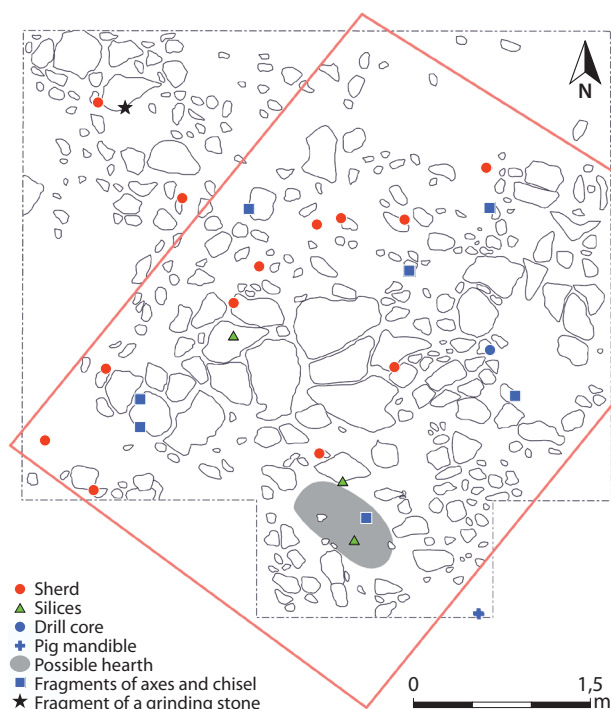


Fig. 4. Hohler Stein near Schwabthal. Drawing of the potential Corded Ware Culture log hut site in trench 9.

somewhat wider northwest side likely. Of course, the overall interpretation remains somewhat hypothetical due to the incomplete excavated area, but it is clearly supported by the distribution of the finds. It is striking that, in contrast to the Motzenstein site, hardly any pottery was found, but rather lithic artefacts. This can easily be explained by erosion, as the much lighter pottery and bones are more easily transported. Heavier stone artifacts tend to remain in their original locations. Ultimately, the Hohler Stein site represents the final remains of a settlement that had already been severely destroyed by natural processes. The few ceramic remains are very similar to the settlement pottery of Wattendorf-Motzenstein as demonstrated by their oxidising firing, the predominantly reddish colouring and the tempering with sand, grog and in some cases also calcium carbonate. From a typological point of view, there is also a great deal of uniformity. This is also true for the stone tools. Rectangular and trapezoidal axes and chisels, some with facets on the edges, are characteristic (Fig. 5). A drill core, work debris and medium to fine-grained sandstones indicate that, as at Motzenstein, axe manufacture took place on site. The raw material has not yet been analysed, but the majority of the pieces shows a high macroscopic similarity with the finds from Wattendorf-Motzenstein, which were determined as *Aktinolith-Hornblende-Schist*. A grinding stone fragment made of coarse-grained sandstone, which was found in the northwestern part of trench 9



Fig. 5. Hohler Stein near Schwabthal. Fragments of axes and chisels and a drill core from trench 9 (Photos: Gertraud Gerner).

and thus very probably outside the house site or in the area of the potential pathway, proves the presence of grain processing. Two flint blades can be linked quite certainly to the Final Neolithic occupation (Fig. 6). The larger piece, 9 cm long and 2.7 cm wide, is dorsally retouched on both longitudinal edges and shows traces of resharpening on one edge. The raw material in this case consists of a non-specific, whitish-to-beige coloured Jurassic chert. Another blade, 4.5 cm long and 1.5 cm wide, with dorsally retouched longitudinal edges, is made of a white-grey quartzite. This raw material, whose exact origin is very difficult to determine, was not used at Motzenstein. With one exception, there are no flakes from the Corded Ware settlement area of trench 9, but this does not necessarily mean that



Fig. 6. Hohler Stein near Schwabthal. Flint blades (Left: Jurassic chert; right: quartzite; photos: Gertraud Gerner).

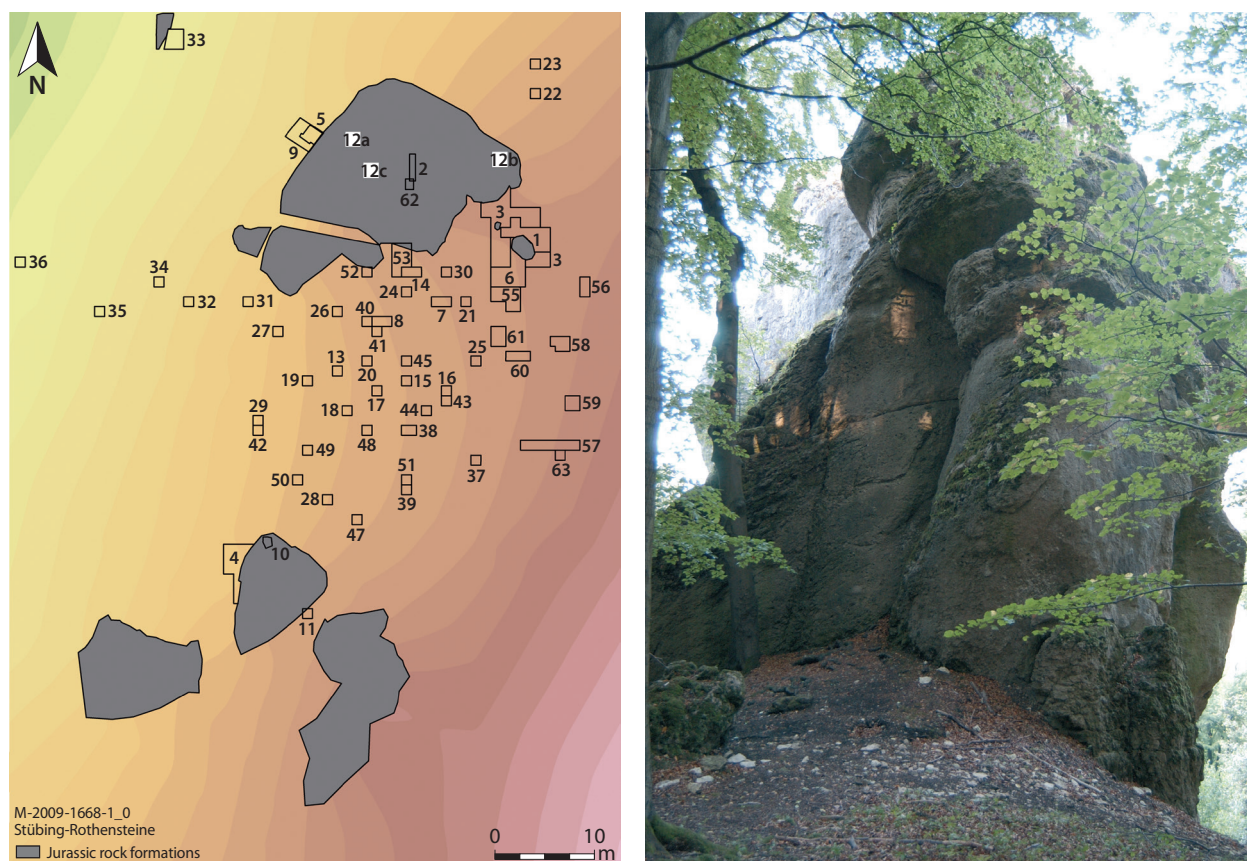


Fig. 7. Rothensteine near Stübig. *Left*: Contour map of the site (pink = high, green = low) with trenches 1–63. *Right*: View from the east to the larger Rothenstein (Photo: Timo Seregély).

chert tools were not regularly produced on site. The light flakes may have been displaced with the eroded sediment. Little information is available regarding the bones. Parts of a pig mandible were found in trench 9, and within the ^{14}C dating series, a total of five samples can be assigned to the Corded Ware occupation phase. These are one cattle bone, one pig bone and three horse bones. This again underlines the importance of the horse, which was evident at Motzenstein. Variable growth sizes suggest that these are already domesticated horses (Becker 2008). A paleogenetic study of horses revealed that a massive spread of horses of the DOM2 type, which originated in the North Pontic region, did not occur until the end of the 3rd millennium (Librado *et al.* 2021). The Final Neolithic horses from Hohler Stein, which were part of this study, also obviously descended from autochthonous wild horse populations. It remains unclear whether they were already domesticated and ridden. This would require similar evidence of bone modifications and riding-induced injuries of Corded Ware people as recently demonstrated in relation to Yamnaya burials (Trautmann *et al.* 2023).

The *Rothensteine* near Stübig, two imposing rock towers about 40 m apart, were already briefly in focus

in 2003 as part of the archaeological investigations at Motzenstein (Fig. 7). The small test trench 1 in the area of an 8x8 m levelling at the eastern rock base of the larger *Rothenstein* revealed a 20–50 cm thick, black-brown sediment, which was strongly mixed, especially at the upper level. This layer mainly contained fragments of Metal Age pottery and small fragments of broken or splintered animal bones from ritual activities from the Early Bronze Age to the Late Latène period. Among other things, vessels were carried up to the 20 m high rocky peaks, which could only be climbed with very good alpine experience or with specially constructed wooden scaffolding, and then, in some cases, deposited or deliberately thrown down. The low quantity of Corded Ware sherds and stone artefacts typical of the period from the 2003 excavation, along with the unsuitable terrain implied a purely ritual context for the material (Seregély 2008a, 129–134). It was therefore quite plausible that the tool debris were also relics of Final Neolithic weapon production at a numinous site that lent the objects produced there a special significance or power. After a second small campaign in 2007, which was intended to further explore the potential of the site, Corded Ware finds were also found

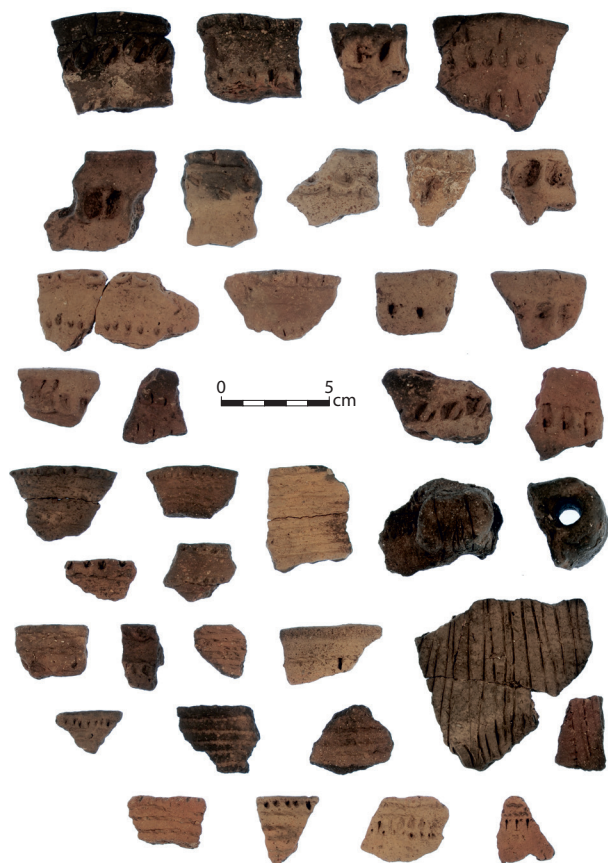


Fig. 8. Rothensteine near Stübig. Sherds of Corded Ware Culture settlement pottery (Photos: Gertraud Gerner).

in trench 4 on the smaller *Rothenstein*. Their location suggests a direct connection with activities on the rocky summit or in front of the west face of the rock tower. The site of *Rothensteine* was then the focus of the project to investigate the ritual use of the rock formations, especially in 2009, with small test trenches exploring all areas of the site, including both summits and especially the slope area between the two rock towers (Seregély 2012a). Evidence of Corded Ware artefacts has been found on the rocky peaks of both the larger and smaller *Rothenstein*. This means that it is very likely that they were used for ritual purposes as early as the 3rd millennium BCE. A number of metal artefacts have also been documented for the Metal Age, including the *in situ* deposition of a Late Bronze Age winged axe. However, the abundance of fragments of typical Corded Ware pottery deposited between the rocks in the slope area, such as *Strichbündel* amphorae, pots with pinched mouldings and stitched decoration as well as beakers with combined cord and in some cases, stitched decoration (Fig. 8), was intriguing. Moreover, two fragments of miniature clay axes and a wheel model can be mentioned. Like the finds from Hohler Stein near Schwabthal, the pottery is



Fig. 9. Rothensteine near Stübig. Adze blanks, semi-finished products of lithic tools, drill cores and Jurassic chert artefacts (Photos: Gertraud Gerner).

very similar to the settlement finds from Motzenstein, and the same applies to the lithic finds (Fig. 9). Thus, the stone debris, especially axe blanks, semi-finished products and drill cores, again consists of amphibolite, while the silices consist exclusively of Jurassic chert. The latter is predominantly local and again of inferior quality. It is a whitish-grey, light-coloured material, which often shows a white-blue patina. One blade was made from the grey-brown, marbled Jurassic chert from the Middle Franconian Jura, which was found on the Motzenstein in numerous cases in the form of finished tools. The type of edge-retouched blade scrapers characteristic of the Motzenstein finds also appears in the material of the *Rothensteine*. Grinding stones made of coarse sandstone and polishing stones made of medium- to fine-grained sandstone, as well as some bone tools, also bear witness to productive activities in the immediate vicinity of the rock towers. The few rolled fractures in the Corded Ware sherds make a long-distance displacement, for example from the edge of the plateau approx. 80 m above the rocks, quite unlikely. An attempt was therefore made to magnetically survey the steep slope immediately to the east over an



Fig. 10. Rothensteine near Stübig. Trenches 57/63 with vertically chipped, smoothed limestone rock face and small, fissure-like ditch. View from above and southwest (Photo: Timo Seregély).

area of 20x20 m using a single-axis fluxgate gradiometer. The magnetogram showed some elongated, north-east-southwest orientated positive anomalies, which, however, fluctuated in strength. Test trenches were then made at four locations. The result was astonishing and showed in all cases that the hard limestone rock had been chipped vertically to a depth of 60 cm. In trench 57 and its extension 63, there was a smoothed limestone rock face with a small, fissure-like ditch up to 8 cm wide in front of it (Fig. 10). This crevice-like depression presumably accommodated the plank wall of a small building, whereupon the neighbouring, originally rough limestone rock face was clearly smoothed by water running off the wooden wall. A concentration of pieces of burnt clay was noticeable in this area, indicating that the wall had, at some point, been plastered. Down the slope, this feature was followed by a sediment layer, which contained Corded Ware finds with a low degree of rolling, particularly at the lowest level. A few charred remains of cereals were also found in this layer, which, together with the large number of grinding stone fragments also recovered, provide evidence for the cultivation and processing of crops. In the western and downslope part of trench 57, an angular hole of about 50x50 cm was found in the rocky

ground, probably used to hold a massive support post. Given the steep slope, the small wooden buildings, which were to be expected, must have been built in a construction method offset from the ground in the lower area. In the case of trenches 57/63, support posts of just under 2 m in length were required, assuming a hut width of approx. 5 m. The situation was similar in trench 59. Here, too, the limestone subsoil was chipped vertically to a depth of approx. 50 cm, but the rock face was not smoothed as in the previous example (Fig. 11). At the base was a kind of flat stone sill, on which part of a sill beam construction probably rested. Thus, the hut wall was not directly on the fractured limestone cliff face, which is why there was no smoothing by water runoff as in trench 57/63. Again, a layer of sediments containing Final Neolithic artifacts was immediately adjacent to the feature in a westerly direction, *i.e.* down the slope. The observed features thus provide unexpectedly clear evidence of settlement structures in a topography that can be characterised as extreme for settlement conditions. The Corded Ware Culture settlers accepted the extremely unfavourable conditions for building huts, which demonstrates the importance of the rock formations for these people even more impressively than



Fig. 11. Rothensteine near Stübig. Trench 59 with vertically chipped limestone rock face and stone sill. View from above and southwest (Photo: Lydia Hendel).

at Motzenstein and Hohler Stein. In contrast to the subsequent Metal Ages, when the site was used purely as a ritual site, people settled in the immediate vicinity of the striking dolomite rocks in the period around 2600 BCE (Fig. 12–14). This is confirmed by the so far only ^{14}C -date from the *Rothensteine*, which falls exactly into the period already documented at Motzenstein and Hohler Stein. The Franconian sites differ from those interpreted as sanctuaries, such as Bacín in Bohemia (Turek 2022), due to the clear evidence of settlement features and land use in the surrounding area.

Associated burials could be assumed to be in the immediate vicinity of the settlements, but in most cases were probably already destroyed by agricultural activities in the Middle Ages and modern times. For example, a faceted battle axe found only 100–200m south of the Hohler Stein near Schwabthal can be interpreted as a grave good from a burial destroyed by ploughing (Fig. 14.7). On the plateau above the *Rothensteine*, there is a burial mound site with rather small and flat mounds (Fig. 14.8). It can be strongly assumed that there are also Corded Ware burials here, which does not rule out a later Metal Age occupation of the burial site. One of the only two known Corded Ware burials in Upper Franconia from the Deisenstein near

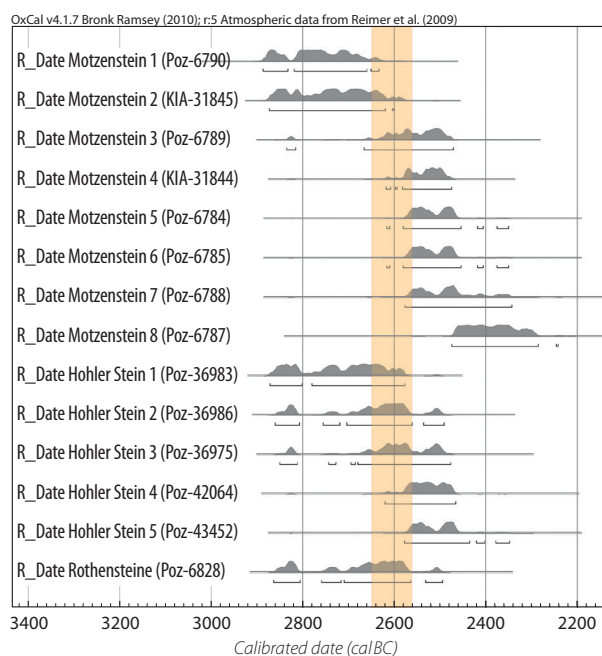


Fig. 12. Radiocarbon dates from Motzenstein, Hohler Stein and Rothensteine.

Kümmersreuth (Fig. 14.6) was also discovered in the area presented here (Seregély 2008a, 164–166). A radio-carbon date also indicates that it belongs to the time horizon of the settlements discussed here, around 2600 BCE. It is possible that the burial belonged to an as yet undiscovered or already destroyed settlement a little further west, where there are also rock formations. Further potential settlements related to Jurassic rocks can be surmised at the *Siebensteine* near Großziegenfeld (Fig. 14.4) and in the area of the Mellenberg near Kümmersreuth (Fig. 14.5). Both sites yielded artefacts, including the typical reddish-fired Corded Ware Culture settlement pottery, silices and amphibolite-like rock debris. On the slope of the Mellenberg, below the rock formations, a fragment of a wheel model and a sherd with herring bone decoration were also found. The latter is the first evidence of this ornamental motif in the North Franconian Jura and can be considered as one of the rare influences from Middle or Lower Franconia. The character of the few finds from the Kemitzenstein near Kümmersreuth (Fig. 14.9) suggests rather sporadic visits to this impressive rock massif (Seregély 2012b). The find of a *Rillenbecher* fragment apparently belongs to the early Corded Ware period around 2700 BCE, whose temporary presence on the Northern Franconian Jura is thus also attested. A faceted axe fragment, which was secondarily used as a tapping stone, can also be linked to the Final Neolithic. It is possible that the sparse finds from the Kemitzenstein represent a somewhat older Corded Ware phase, in which, at least at this site, there was no prolonged settlement.

Thus, in a rather small area of approx. 6x5 km, there are three certain and two probable indications of small settlements at distances of 2–4 km from each other. The burials are to be expected in the immediate vicinity of these small settlements and concrete evidence for them has already been cited (see above). All sites with a settlement character reveal a clear connection to conspicuous rock formations. The surrounding soils have a loess component and were ideally suited for cereal cultivation in the 3rd millennium BCE. However, strong erosion processes, which were exacerbated by prehistoric and especially medieval to modern agricultural use, have caused a reduction or complete erosion of the loess horizons. Drinking water was supplied by springs located between 200 and 1000 m from the settlements. The construction of cisterns or the use of dolines compacted with clay as water reservoirs should also be considered.

Other Corded Ware Culture sites in the immediate vicinity of Jura rock formations are known in the wider area of the Northern and Middle Franconian Jura beyond the small region we have just considered, and which are also possible settlement sites. In Upper



Fig. 13. Map of Germany with the region of the Corded Ware Culture sites in Upper Franconia marked with a black square (Map: Karin Winter).

Franconia, these include the Gügel and the Giechburg near Zeckendorf (Seregély 2008a, 300; 319), the Hoher Stein near Stücht (*ibid.*, 317) and the Högelstein near Rettern (*ibid.*, 323). For the Upper Palatinate, the Burgberg near Lichtenegg (Kirpal 2002) and for Middle Franconia the Hochberg near Mittelburg (Nadler and Sörgel 1997; Sörgel 1996) should be mentioned.

Corded Ware hamlets in the immediate vicinity of conspicuous Jura rocks are clearly not an exceptional phenomenon in the Franconian Jura, but actually occur quite frequently in a phase of the Final Neolithic around 2600 BCE. This reveals a specific settlement pattern that certainly did not arise by chance. It is more likely that the settlers of the Corded Ware Culture had a specific motive for settling in the immediate vicinity of the rock towers or massifs. The most plausible explanation seems to be a deliberate combination of a suitable settlement and ritual site, with the imposing rocks providing an extraordinary backdrop for the latter. Perhaps the rocks, as conspicuous natural formations, were also a kind of territorial marker and thus of symbolic or identity value for the smaller family groups or clan-like social structures which can currently be assumed to exist in the Corded Ware Culture. From a demographic point of view, strong communication

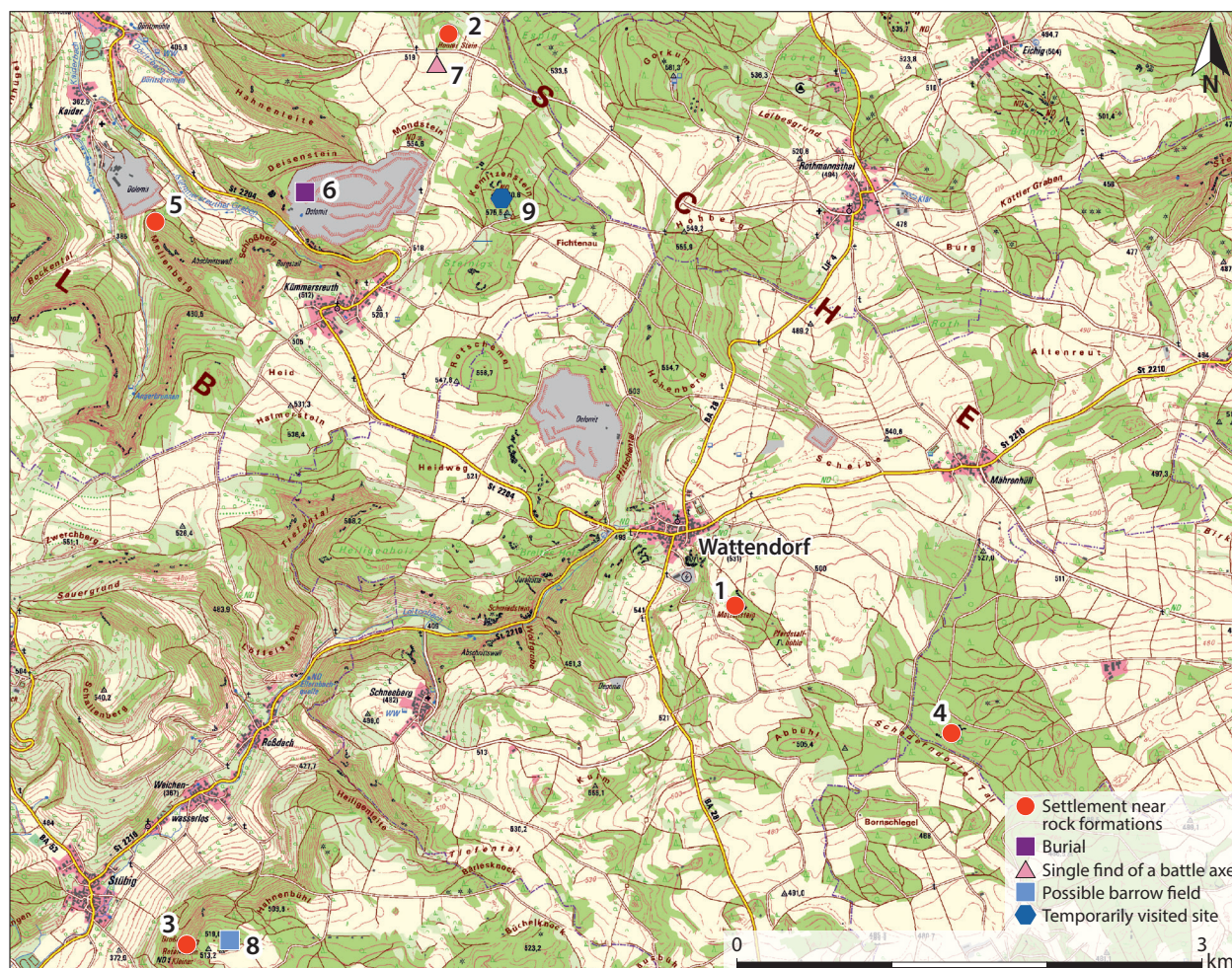


Fig. 14. Detailed topographical map with all mentioned sites: 1 Motzenstein, 2 Hohler Stein, 3 Rothensteine, 4 Siebensteine, 5 Mellenberg, 9 Kemtzenstein (Map: Topographical map © Landesamt für Digitalisierung, Breitband und Vermessung, München; modified).

and increased mobility are essential for this settlement and social structure, which is also evident in the visible

uniformity of the pottery and the sourcing of raw materials (Müller and Seregély 2008b).

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Licht in finstere(n) Zeiten

Drei Beispiele zu den sogenannten *Dark Ages* aus der Ur- und Frühgeschichte Schleswig-Holsteins

Claus v. Carnap-Bornheim, Sönke Hartz

KEYWORDS: *Middle Palaeolithic; early Holocene; end of the Roman Empire and the beginning of the Viking Age; archaeological and methodological problems*

Zusammenfassung

In der Ur- und Frühgeschichte Schleswig-Holsteins sind auch nach Jahrzehnten bzw. Jahrhunderten archäologischer Forschung einzelne Perioden bzw. Zeitabschnitte im archäologischen Fundmaterial deutlich unterrepräsentiert oder nur durch spärliche Informationen zu rekonstruieren und zu interpretieren. Dazu gehören beispielsweise das Mittelpaläolithikum, das frühe Holozän und die Jahrhunderte seit dem Ende der römischen Kaiserzeit und dem Beginn der Wikingerzeit.

In diesem Beitrag wollen wir zunächst die jeweilige Forschungssituation beschreiben und ausgewählte Fund-

materialien bzw. Befunde präsentieren. Dabei wird deutlich, dass neue — zum Teil überraschende — Erkenntnisstände sowohl durch individuelle Aktivitäten, durch interdisziplinäre Forschungsansätze, durch die Weiterentwicklung naturwissenschaftlicher Methoden und auch durch geänderte gesetzliche Rahmenbedingungen ausgelöst werden können. Letztlich öffnet sich so das Fenster zu auch epocheübergreifenden Interpretationsmodellen zu sozialer Organisation, ökonomischen Praktiken und politischer Neuformation.

Abstract

Even after decades or centuries of archaeological research, individual periods or time periods in the pre-history and early history of Schleswig-Holstein are clearly underrepresented in the archaeological finds or can only be reconstructed and interpreted with sparse information. These include, for example, the Middle Palaeolithic, the early Holocene and the centuries since the end of the Roman Empire and the beginning of the Viking Age.

In this article, we will first describe the respective research situation and present selected finds and findings. It will become clear that new — sometimes surprising — findings can be triggered by individual activities, by interdisciplinary research approaches, by the further development of scientific methods and also by changes in the legal framework. Ultimately, this opens the window to models for interpreting social organisation, economic practices and political reform across epochs.

EINLEITUNG

In der Ur- und Frühgeschichte Schleswig-Holsteins sind auch nach Jahrzehnten bzw. Jahrhunderten archäologischer Forschung einzelne Zeitabschnitte im archäologischen Fundmaterial deutlich unterrepräsentiert oder nur durch spärliche Informationen zu rekonstruieren und zu interpretieren. Dazu gehören u. a.

das Mittelpaläolithikum, das früheste Holozän und die Jahrhunderte seit dem Ende der römischen Kaiserzeit bis zum Beginn der Wikingerzeit. Sie können somit als *Dark Ages* in der schleswig-holsteinischen Landesgeschichte bezeichnet werden.

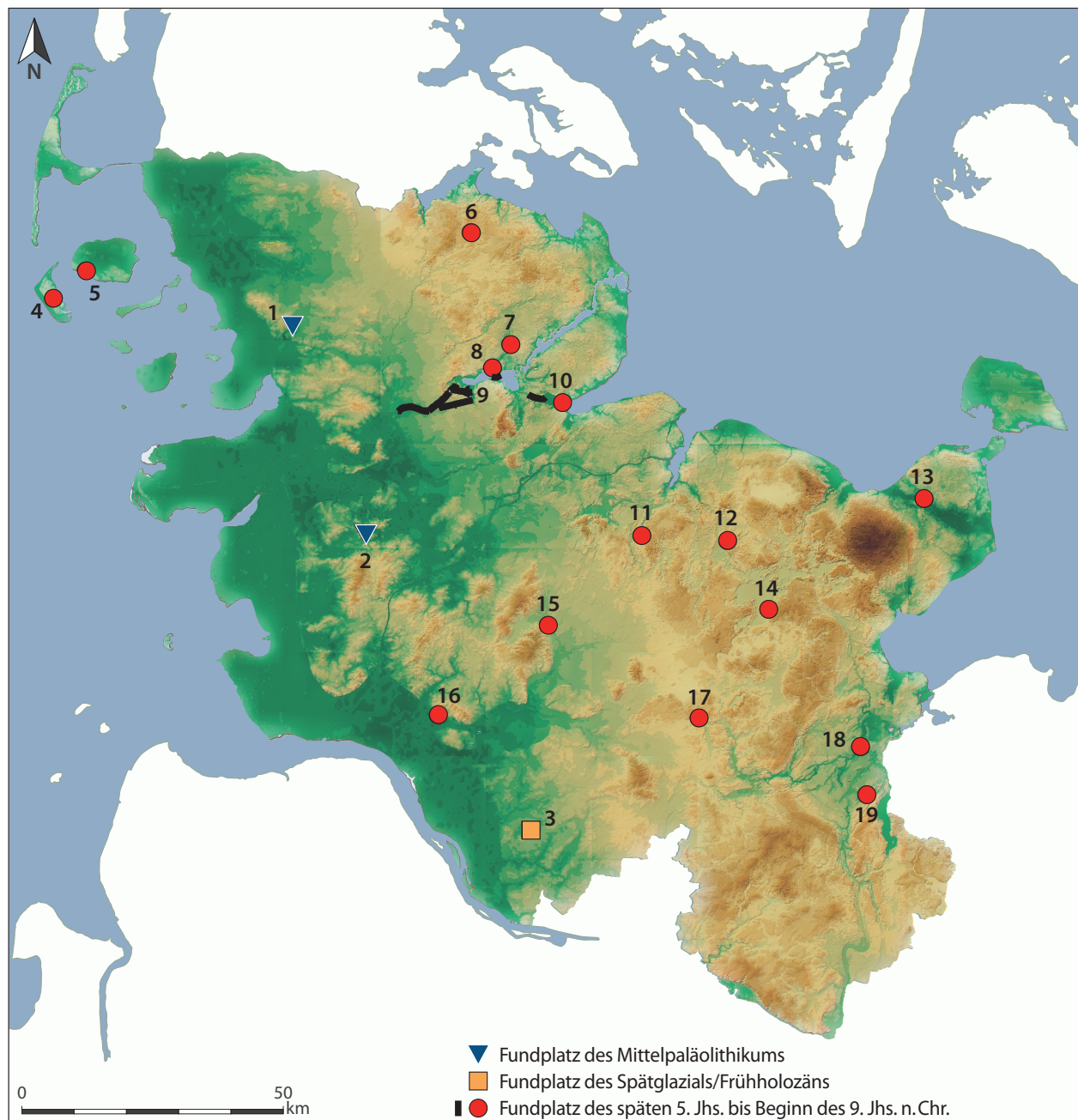


Abb. 1. Im Text erwähnte Fundplätze. **Dreiecke:** Fundplätze des Mittelpaläolithikums. 1 Drelsdorf (Schmallacker); 2 Schalkholz; **Quadrat:** Fundplatz des Spätglazials/Frühholozäns; 3 Seeth-Ekholt; **Kreise:** Fundplätze des späten 5. Jhs. bis zum Beginn des 9. Jhs. n. Chr.; 4 Nebel, Amrum; 5 Witsum, Föhr; 6 Husby; 7 Taarstedt; 8 Füsing; 9 Danewerk; 10 Eckernförde; 11 Flintbek; 12 Scharstorf (Burg); 13 Oldenburg i.H.; 14 Bosau; 15 Aukrug; 16 Heiligenstedten; 17 Wittenborn; 18 Alt Lübeck (Burg); 19 Klempauer Moor (Karte: Jörg Nowotny).

Traditionell sind Sammler und Sammlerinnen besonders von Steinartefakten eine wesentliche Quelle der archäologischen Landesforschung — und dies schon seit mehr als 100 Jahren. Sie lieferten und liefern jene Daten, die in der Archäologischen Landesaufnahme des Archäologischen Landesamtes Schleswig-Holstein erfasst und ausgewertet werden. Doch hat sich

die Situation in Schleswig-Holstein in den letzten zwei Jahrzehnten in einzelnen Bereichen grundsätzlich geändert. Dies ist einmal bedingt durch die konsequente Umsetzung des Verursacherprinzips in der archäologischen Denkmalpflege und mit weitreichenden neuen Erkenntnismöglichkeiten für die Metallzeiten, zum anderen ist die Integration der Detektorgänger:innen

in das denkmalpflegerische und wissenschaftliche System des Bundeslandes zu nennen. Dadurch gewannen die Archäologischen Nachrichten Schleswig-Holstein, die seit 2008 in einem neuen Layout und mit neuer Ausrichtung erschienen, ein ganz neues Gewicht für die archäologische Landesforschung. Ein Ergebnis dieses neuen Profils waren die auch von Johannes Müller mit herausgegebenen Archäologischen Nachrichten 2020 mit dem Titel Horizonte, die anlässlich des Deutschen Archäologie-Kongresses im Jahre 2020 und der Tagung der European Association of Archaeologists (EAA) im Jahr 2021 erschienen. Leider konnten beide Kongresse während der Pandemie nur digital durchgeführt werden, was für alle Beteiligten eine große Enttäuschung war.

Neben diesen beiden neuen Linien in der archäologischen Landesforschung treten wie immer auch objektorientierte Grabungen, Neufunde aus der Sammlerszene und die Publikation von Materialien, die in den Magazinen der Museen auf Auswertung warten. Wird dies nun zusammenbetrachtet, so wird deutlich, dass neue – zum Teil überraschende – Erkenntnisstände sowohl durch individuelle (Sammler-)Aktivitäten, durch interdisziplinäre Forschungsansätze, durch die Weiterentwicklung naturwissenschaftlicher Methoden als auch durch geänderte gesetzliche Rahmenbedingungen ausgelöst werden können. Letztlich öffnet sich so das Fenster zu auch epochenübergreifenden Interpretationsmodellen zu sozialer Organisation, ökonomischen Praktiken und politischer Neuformation.

MITTELPALÄOLITHISCHE ARTEFAKTE NÖRDLICH DER ELBE – ERREICHTE DER NEANDERTALER DEN NORDEN?

Seit über 100 Jahren wird die Anwesenheit von Neandertalern nördlich der Elbe kontrovers diskutiert. Tatsächlich handelt es sich bei den meisten faustkeilartigen Stücken von der Ostseeküste um Vorarbeiten zu blattförmigen Flintgeräten oder Kernbohrern des Spätneolithikums (Johansen und Stapert 1995/96; Petersen 1993) und nicht um mittelpaläolithische Geräte. Darüber hinaus entpuppten sich viele als „paläolithisch“ diagnostizierte Flintstücke bei genauerer Analyse als Naturprodukte (Geofakte; Hartz und Fiedler 1997).

Erst die Entdeckung von 11 Fundstücken in Schalkholz (Schalkholz LA 66, Kr. Dithmarschen) im westlichen Altmoränengebiet in einer frühweichseleiszeitlichen Bodenbildung durch Volker Arnold im Jahr 1977 brachte den entscheidenden Hinweis auf die Präsenz von Neandertalern nördlich der Elbe (Arnold 1978). Mittels Pollenanalysen konnte die Fundschicht in eine frühe Warmphase (Brørup-Interstadial) der letzten Eiszeit vor ca. 90.000–105.000 Jahren datiert werden.

In den 1980er Jahren rückte ein Oberflächenfundplatz bei Drelsdorf (Drelsdorf LA 50, Flurbezeichnung „Schmallacker“) im Kreis Nordfriesland in den Fokus der Paläolithforschung (Abb. 1). Dort hatte der Landwirt und Amateurarchäologe Hans Ingwer Boockhoff bereits seit Ende der 1960er Jahre einen Faustkeil und weitere Flintwerkzeuge entdeckt (Abb. 2.1–6), die sehr markante Oberflächenmodifikationen aufweisen. Dazu zählen matt bis stark glänzende Polituren (wind gloss, Abb. 2.7), stark abgerundete und verschliffene Kanten, Frostrisse, pockennarbige oder gekritzte Oberflächen (Abb. 2.8) sowie mikroskopisch kleine Vertiefungen (*small pits*; Hartz 1986; Stapert 1976). Diese Merkmale entstanden infolge von Permafrost und Sand- bzw. Staubbdrift und können nur zur Zeit des Weichselhochglazials auf den eisfreien Moränenkuppen der Saaleeiszeit entstanden sein. Die Fundstücke müssen also älter

sein als das Hochglazial vor ca. 25.000 Jahren. Die Entdeckungen von Boockhoff sind ein absoluter Glücksfall für die Forschung, denn nun konnte mit den Zufallsfunden von Drelsdorf und dem kleinen Inventar aus Schalkholz das Mittelpaläolithikum in Schleswig-Holstein sicher nachgewiesen und eine urgeschichtliche Forschungslücke geschlossen werden.

Ab dem Jahr 2015 wurden die Forschungsaktivitäten in Drelsdorf-Schmallacker nach längerer Pause neu aktiviert. Von 2015–2018 haben ehrenamtliche Helfer aus den Niederlanden und Schleswig-Holstein unter der Leitung des Archäologen Jaap Beuker aus Assen systematische Geländebegehungen durchgeführt. Zu diesem Zeitpunkt wurde der Arzt Jürgens aus Flintbek auf die Fundstelle aufmerksam und konnte durch akribische und systematische Sammeltätigkeit zwischen den Jahren 2018 und 2023 dem Altbestand über 30 mittelpaläolithische Artefakte hinzufügen. Voraussetzung für seinen Sucherfolg waren die Analyse der Drelsdorfer Altfunde sowie eine intensivierte mikroskopische Untersuchung der spezifischen Oberflächenmodifikationen, insbesondere von wind gloss. Die seit dem Jahre 2015 durchgeführten GPS-gestützten Einzelmessungen dokumentieren eine Verdichtung der Artefakte im Nordwesten von Drelsdorf-Schmallacker, die als Indiz für einen oberflächennahen Fundhorizont gewertet werden kann.

Unter den Neufunden aus den Jahren 2021 und 2022 stechen besonders zwei Werkzeuge heraus: zum einen handelt es sich um ein 8,5 cm langes, 4,7 cm breites und 1,1 cm dickes blattförmiges Flintgerät aus einer Frostscherbe, das entweder einen Schaber oder eine Blattspitze darstellt (Hartz *et al.* 2022; Abb. 3.1). Für einen Schaber spricht die formgebende flächige Retusche auf der Oberseite, die zur Ausdünnung des Gerätekörpers und zur Anlage der konvexen Arbeitskante diente.



Abb. 2. Drelsdorf LA 50. Mittelpaläolithische Flintgeräte aus der Sammlung Boockhoff. 1–2 Faustkeile; 3–6 verschiedene Schaberformen; 7–8 zwei der charakteristischen Oberflächenmodifikationen auf Abschlägen (Fotos: Museum für Archäologie, Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorf).

Überzogen ist das gesamte Fundstück mit einer feinen Glanzpolitur (wind gloss), die Kanten sind durch sedimentäre Einflüsse alt verschliffen. Das zweite Stück ist ein 9,4 cm langer, 5,1 cm breiter und 1,6 cm dicker Schaber von grob dreieckiger Form mit stufig retuschierter, schwach konvexer Arbeitskante (frd. mdl. Mitt. Hauke Jürgens, Abb. 3.2). Das Gerät wurde aus einem Abschlag gefertigt und weist eine flächendeckende Glanzpolitur (wind gloss) auf. In Größe, Form und Retuschierung der Arbeitskante zeigt es Parallelen zu einem Altfund aus der Sammlung Boockhoff (Hartz 1986, Abb. 4.10).

Die neuen diagnostischen Werkzeuge lassen nunmehr keinerlei Zweifel daran, dass in Drelsdorf die

Überreste eines Lagerplatzes aus dem Mittelpaläolithikum entdeckt wurden. Inzwischen mehrten sich anhand von charakteristischen Werkzeugen und flachen, teils in Levalloistechnik abgebauten Kernsteinen (Weber *et al.* 2023; freund. mündl. Mitt. Dirk Leder) die Anzeichen dafür, dass das Inventar ins MIS 4 vor 60.000–80.000 Jahren zu datieren ist. Es steht damit in einer Reihe mit mittelpaläolithischen Fundstellen in den Niederlanden (Niekus und van Ginkel, 2019) und Niedersachsen (Hein *et al.* 2021; Kegler und de Fries 2018; Thieme und Werben 1989) und eröffnet neue Forschungsperspektiven zur Frage, wann und wie weit die Neandertaler nach Norden vordrangen.

SPÄTGLAZIAL ODER FRÜHHOLOZÄN? EIN FLINTINVENTAR DER LONG BLADE INDUSTRY AUS DEM SÜDLICHEN SCHLESWIG-HOLSTEIN

In Schleswig-Holstein gehören Fundinventare mit Long Blades (Riesenklingen) seit dem Monumentalwerk von Wolfgang Taute über die späteiszeitlichen

Stielspitzengruppen (Taute 1968) zur (jüngeren) Ahrensburger Kultur. Diese ist in Schleswig-Holstein und im nordwestlichen Niedersachsen von Wolfgang Taute

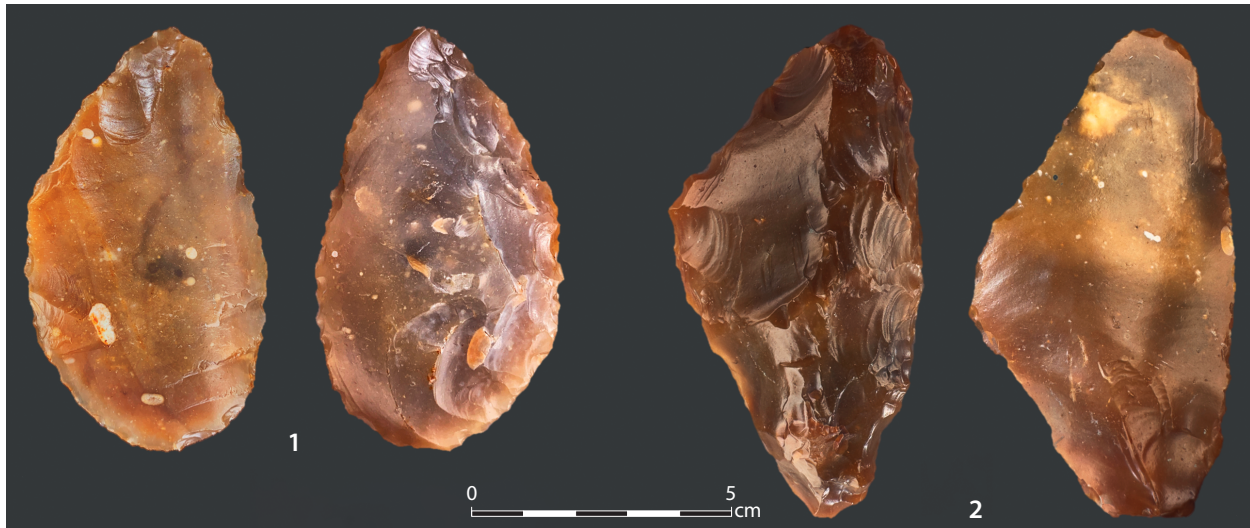


Abb. 3. Drelsorf LA 50. Mittelpaläolithische Neufunde aus den Jahren 2021–2023. 1 Schaber; 2 Blattspitze/Schaber (Fotos: Hauke Jürgens).

als Eggstedt-Stellmoor-Gruppe bezeichnet worden. In West- und Nordwesteuropa werden entsprechende Fundplätze allgemein dem Long Blade Industries (LBI)-Technokomplex zugeordnet und sind von Nordfrankreich (*bruised blades-horizon* bzw. Belloisien: Fagnart 1997; Naudinot *et al.* 2019; Valentin 2008) über Belgien, die Niederlande (Niekus *et al.* 2018) und England (Barton und Roberts 2019; Conneller *et al.* 2019) bis nach Nordwestdeutschland (Baaes *et al.* 2015) und Dänemark (Sørensen und Sternke 2004) verbreitet. Von LBI-Fundstellen liegen aus Deutschland mit Ausnahme der Daten von Ahrensburg (Stellmoor) LA 78 (Kr. Stormarn; Grimm *et al.* 2020) nur wenige absolute Datierungen vor, darunter ein Radiokarbonalter von

10.018–9671 v.Chr. (2σ) aus Dormagen-Nievenheim (Heinen 2016), das aus dem Übergangshorizont vom Spätglazial zum Holozän stammt. In Schleswig-Holstein sind seit den Untersuchungen Wolfgang Tautes neue Sammelinventare hinzugekommen (Abb. 1), die hauptsächlich im südlichen Landesteil liegen (Clausen 2014; Grimm und Detjens 2023). Bei Oberflächenfunden ist eine Vermischung mit jüngeren Artefakten nicht ausgeschlossen, allerdings liegen die LBI-Stationen häufig so exponiert in der Landschaft, dass sie offensichtlich für mittel- bis spätesolithische Jägergruppen und neolithische Bauerngesellschaften unattraktiv waren.

Das nachfolgend beschriebene Inventar stammt aus der Gemeinde Seeth-Ekholt (LA 8) im Kreis Pinneberg und wurde am nordöstlichen Rande des Liether Moores gefunden. Es ist die nördlichste Fundstelle einer größeren Gruppe von späteiszeitlich/frühholozänen Sammelinventaren, die sich überwiegend im südwestlichen Abschnitt des Moores konzentrieren (Grimm und Detjens 2023). Der Platz wurde Ende der 1980er Jahre von Ewald Both aus Heist entdeckt und 2006 dem Archäologischen Landesamt in Neumünster (ALSH) gemeldet. Nach dem Tode von Ewald Both hat der Amateurarchäologe Torsten Wohlenberg aus Kibitzreihe das Flurstück regelmäßig begangen und alle Artefakte einzeln dreidimensional eingemessen. Die Fundstelle liegt auf einem seicht zur Ekholter Au abfallenden Geländesporn, der Ost-West ausgerichtet und Teil einer größeren saalezeitlichen Moränenkuppe ist. Die Artefaktverteilung hat eine Gesamtausdehnung von ca. 500 m² und wird durch einen Feldweg mit angrenzendem Wall unterbrochen. Die Gesamtkartierung zeigt eine weitgehend geschlossene Fundstreuung mit einer kleinen, abgesetzten Fundkonzentration im Nordosten

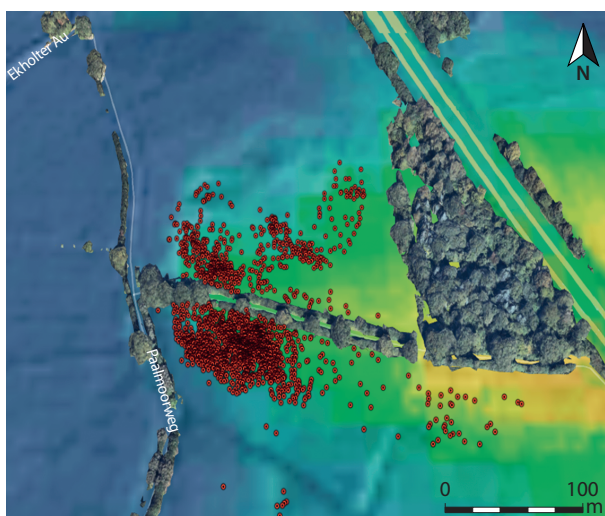


Abb. 4. Seeth-Ekholt LA 8. Gesamtverteilung der Oberflächenfunde (Karte: Torsten Wohlenberg).



Abb. 5. Seeth-Ekholt LA 8. Klingen- und Abschlagwerkzeuge aus Flint. 1–5 Klingenkratzer; 6–10 Abschlagkratzer; 11–15 verschiedene Sticheltypen (Fotos: Torsten Wohlenberg).

sowie einigen wenigen Ausreißern vorwiegend im Südosten (Abb. 4). Sowohl die Klingen und Kernsteine als auch die unterschiedlichen Werkzeugtypen streuen beiderseits des Feldweges, ohne dass sich spezifische Aktivitätszonen abzeichnen.

Nach Aussage von Torsten Wohlenberg ist der Acker seit dem Jahre 2006 permanent unter Pflug, im Jahr 2007 wurden zusammen mit Mitarbeitern des ALSH Neumünster im Bereich der maximalen Funddichte mehrere kleine Schürfe abgeteuft. Dabei stellte sich heraus, dass die Fundschicht komplett durch den Pflug aufgearbeitet war. Unter dem 0,3 m starken Ackerboden

folgt ein bis zu 0,6 m mächtiger heller, sandiger Lehm mit z. T. kopfgroßen Felssteinen und Flintknollen bis zu 0,2 m im Durchmesser, darunter steht roter eiszeitlicher Geschiebelehm an. Nach Aussage des Sammlers ging ab dem Jahr 2021 die Anzahl der Sammelfunde rapide zurück, so dass dort kaum noch Artefakte zu finden sind.

Das Gesamtensemble umfasst ca. 2300 Einzelfunde, darunter 1000 Abschlüge (ohne Absplisse < 1 cm²), 550 Klingen (inkl. Basalfragmente), 345 Kernsteine, 230 Werkzeuge und 120 Stücke gebrannten Flint. Dazu kommen zwei Felsgesteinsplatten aus grobkörnigem

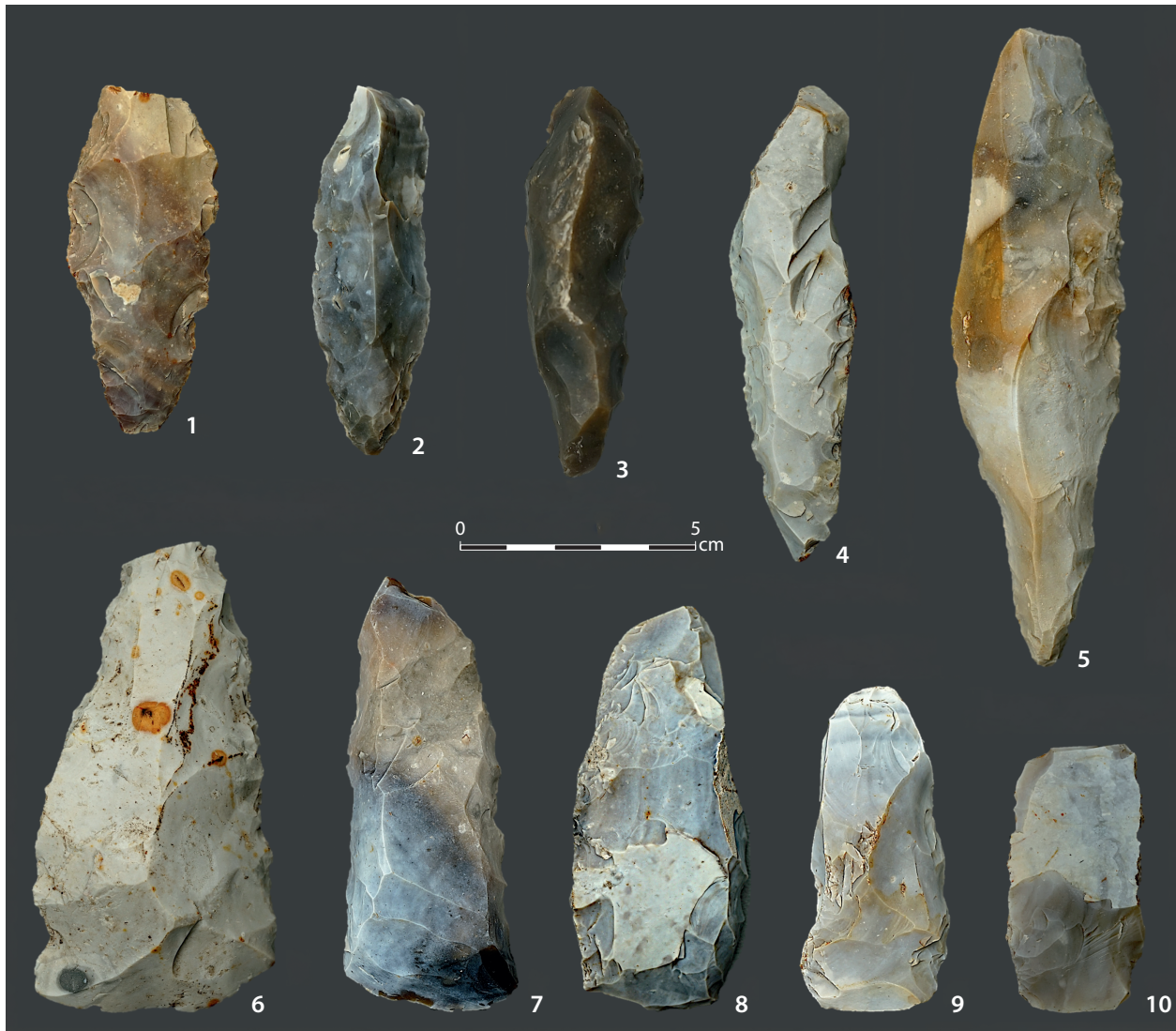


Abb. 6. Seeth-Ekholm LA 8. Kerngeräte aus Flint. 1–5 Kerngeräte mit Spitze (Dreikanter); 6–10 Kernbeile (Fotos: Torsten Wohlenberg).

Quarzit. Die Grundformen wurden zum überwiegenden Teil aus homogenem, grauem Senonflint geschlagen und sind teilweise durch rezente Aussplitterungen kantenbeschädigt. Die Patina weist eine breite Palette an Farbschattierungen auf und variiert von braungrau über rötlichbraun bis hin zu weiß patinierten Stücken. Insbesondere an den größeren Artefakten wie Beilklingen, Riesenklingen und Kernsteinen finden sich Partien mit Sandanhaftungen und Rostflecken, die vermutlich auf den eisenschüssigen Boden zurückzuführen sind.

Im Werkzeugspektrum sind die Kratzer mit 110 Exemplaren am zahlreichsten vertreten (Abb. 5.1–10), wobei Formen aus kurzen, rundovalen Abschlüssen dominieren. Dazu kommen Klingenkratzer mit konvexer, relativ steiler Arbeitskante, unter ihnen auch sehr schlanke, kantenparallele Formen von bis zu 4,0 cm

Länge und 1,5 cm Breite. Innerhalb dieser Gerätegruppe sind häufig nur die Kratzerkappen erhalten geblieben, d. h. die Kratzer sind bereits während der Nutzungsphase abgebrochen. Die zweitgrößte Gerätegruppe bilden die Stichel mit 27 Exemplaren. Sie verteilen sich auf 12 einfache Kantenstichel, acht Mehrschlagstichel, drei Stücke mit bogenförmigem Stichelschlag und vier Eckstichel (Abb. 5.11–15).

Zu den Kerngeräten gehören 14 kernbeilartige Exemplare, die keine echte Schneide, sondern eine prominente Spitze aufweisen (Abb. 6.1–5). Der Querschnitt ist dreiecksförmig („Dreikanter“), die Geräteoberfläche nur grob zugeschlagen, während die Kanten sorgfältig retuschiert wurden. Die Anzahl der Kernbeile (Abb. 6.6–10) ist mit insgesamt 13 Exemplaren ähnlich groß. Ihre Kennzeichen sind oval bis rechteckig-trapezoide

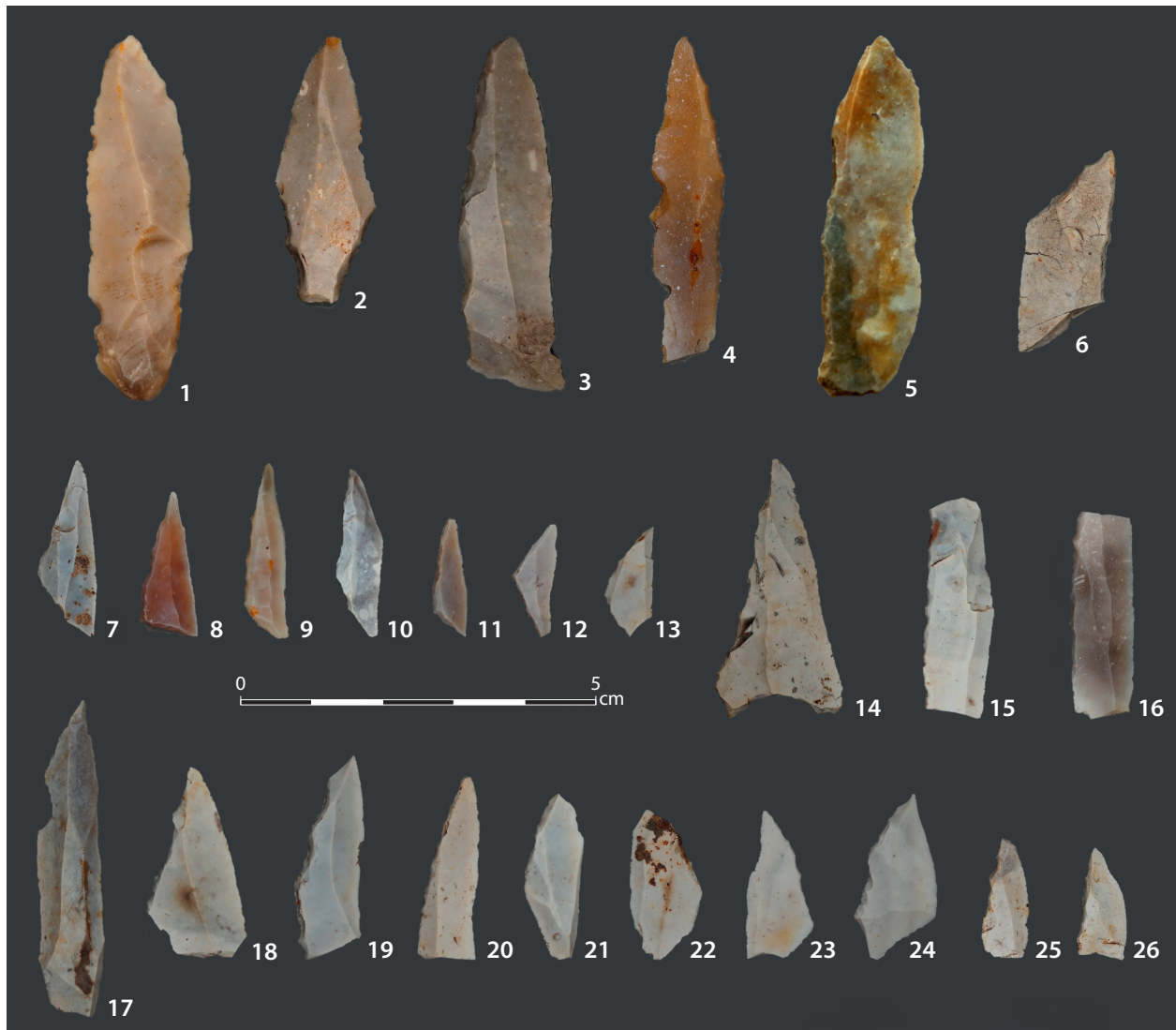


Abb. 7. Seeth-Ekholt LA 8. Geschosspitzen aus Flint. 1–2 Stielspitzen; 3–5 rückenretuschierte Spitzen; 6 Zonhovenspitze; 7–14 Dreiecksmikrolithen; 15–16 Rückenmesserchen; 17–26 einfache Spitzen; (Fotos: Torsten Wohlenberg).

Querschnitte, bifazial zugeschlagene Oberflächen sowie eine eindeutige Schneide, die zumeist durch einen seitlichen Schneidenschlag erzeugt wurde. Vier Geräte mit flacher Unterseite aus einer Alt- oder Frostsprungsfläche und unifazialer Kantenzurichtung stehen typologisch den Scheibenbeilen nahe. Die durchschnittlichen Längenwerte von 5–8 cm sind ein Indiz dafür, dass Beile regelhaft nachgeschlagen wurden. Bohrer sind mit vier Exemplaren selten und gehören ausschließlich zur Kategorie der Kernbohrer. Unter den Sonderformen treten drei dicke, schaberartig retuschierte Abschläge auf, die an den konvexen Arbeitskanten Hackspuren in Form von groben Aussplitterung aufweisen. Dazu kommen drei Klingen mit konvexer oder schräger Endretusche, die häufig als Messer bezeichnet werden (z. B. Sørensen und Sternke 2004, Abb. 9 H). Neben

den typischen Siedlungswerkzeugen gibt es insgesamt 30 Geschosspitzen, zu denen hier auch die Mikrolithen gezählt werden sollen (Abb. 7). Von chronologischer Relevanz sind u. a. zwei kleine Stielspitzen vom Typ Ahrensburg, drei rückenretuschierte Spitzen (Federmesser) und eine rhombische Spitze vom Typ Zonhoven. Unter den Mikrolithen dominieren die einfachen Spitzen mit schräger Endretusche (13 Stücke), dazu kommen ungleichschenklige (4 Stücke) und gleichschenklige (1 Stück) Dreiecksspitzen, Dreiecke mit gerader (3 Stücke) und konkaver Basisretusche (1 Stück) sowie kantenretuschierte Mikroklingen (Rückenmesserchen, 2 Stücke).

In die Kategorie der diagnostischen oder technischen Abfallprodukte gehören basale und terminale Kerbreste (4 St.), Stichelabfälle (5 St., Abb. 8.15–17),

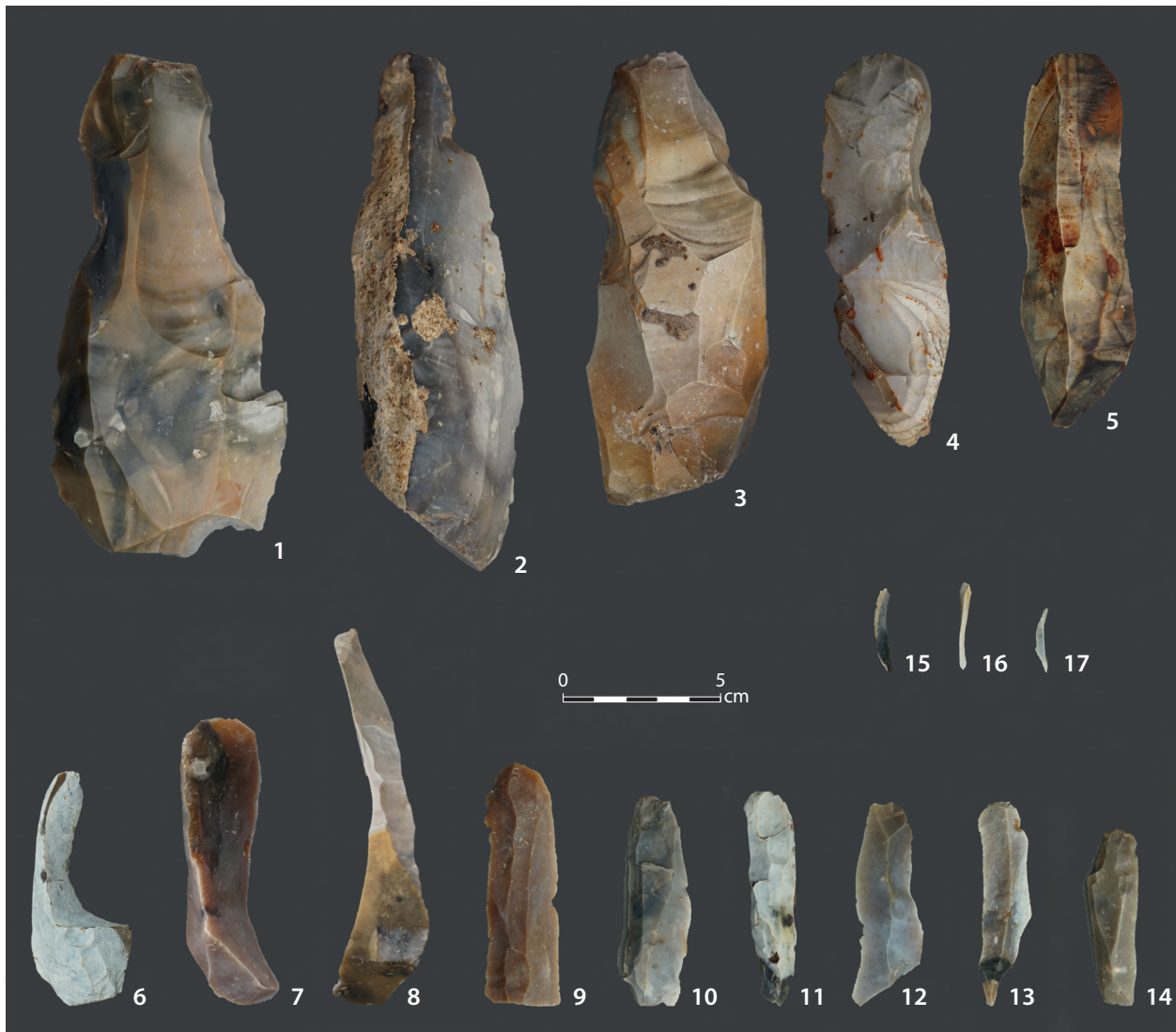


Abb. 8. Seeth-Ekholm LA 8. Klingen und technische Abfallprodukte aus Flint. 1–5 Riesenklingen; 6–8 Kernfußklingen; 9–14 Makroklingen; 15–17 Stichellamellen (Fotos: Torsten Wohlenberg).

Beilschneidenschärfungsabschläge (2 St.), Kernkantenklingen (9 St.), Schlagflächen- und Abbaufächenabschläge (7 St.), Kernfußklingen (120 St.) sowie Kernsteine und Klingen, von denen die letzten beiden in statistisch verwertbarer Anzahl vorliegen. Unter den Grundformen sind typo-technologisch die Riesenklingen mit 22 Stücken (inkl. Fragmente, Abb. 8.1–5) am auffälligsten. Sie erreichen Maximallängen von bis zu 16,2 cm, die größte Breite beträgt 7,2 cm. Die Riesenklingen stammen aus einer primären Klingenabbau-sequenz bei der Zerlegung großer Kernsteine, die eine Nähe zu hochwertigen Rohstoffquellen mit Flintknollen von 20–30 cm und größer vermuten lassen. Das Schlagkonzept der Long Blades zeichnet sich durch glatte, in der Form unregelmäßige, häufig auch breitovale Schlagflächenreste mit halbrunden Schlagaugen

aus. Die Bulben sind meist wenig prominent ausgebildet und weisen Schlagnarben und Strahlensprünge auf. Die dorsalen Ränder an den Schlagflächenresten sind flüchtig reduziert/abasiert worden, was zusammen mit den übrigen Schlagmerkmalen auf eine direkt harte Schlagmethode (harter oder mittelharter Schlagstein) deutet. Die Dorsalflächen einiger Riesenklingen, darunter insbesondere diejenigen der Kernfußklingen (Abb. 8.6–8), sind durch gegenständige Negativbahnen gekennzeichnet, die bei Anwendung des bidirektionalen Schlagkonzeptes entstehen.

Die Auswertung von größeren Restkernen und Kernkantenklingen zeigt indes, dass zum Klingenkonzept sowohl unipolare (prismatische) als auch bipolare Kernsteine mit glatter, unfazettierter Schlagfläche gehören (Abb. 9). Als weiteres technisches Merkmal der



Abb. 9. Seeth-Ekholz LA 8. Kernsteine aus Flint. 1–4 lange bipolare Klingenkernsteine; 5–6 lange unipolare Klingenkernsteine; 7–10 kleine unipolare Kernsteine (Fotos: Torsten Wohlenberg).

Schlagmethode ist festzuhalten, dass Angelbrüche auf der Abbaufäche des Kernsteins häufig mittels partieller Kernkantenabschläge beseitigt wurden. Aufgrund ihrer groben, kantenbegleitenden Aussplitterungen gehören drei Riesenklängen zur Gruppe der bruised blades.

Eine zweite Klängenabbausequenz ist durch Stücke mittlerer Größe zwischen 5,0–8,0 cm Länge und 1,5–2,0 cm Breite gekennzeichnet („Makroklängen“, Abb. 8.9–14). Zu diesen Grundformen gehört ein größeres Kontingent an qualitätsvollen Klängen und Klängenbasalfragmenten, die einen hohen Grad an Kantenparallelität und eine schwache Längskrümmung aufweisen. Diese Stücke dienten auch als Grundformen für Klängenwerkzeuge. Die Schlagflächenreste sind unfazettiert, in der Regel spitzoval bis punktförmig und sorgfältig reduziert/abrsiert, nur wenige sind

gratförmig oder kollabiert. Die Bulben sind diffus ausgebildet und tragen Schlagsnarben, während Strahlensprünge seltener auftreten. Bei Klängen aus dieser Herstellungssequenz fehlen auf den Dorsalfächen die gegenständigen Negative, und auch die entsprechenden Kernsteine sind zumeist unipolar mit einem „spitzen“ Winkel zwischen Abbaufäche und Schlagfläche zwischen 70–80 Grad. Nach Auswertung aller diagnostischen Schlagmerkmale ist festzuhalten, dass sich das Klängenkonzept für Makroklängen nur graduell von der Produktion der Riesenklängen absetzt. Vieles spricht dafür, dass weiterhin die traditionelle direkte Schlagmethode existierte, allerdings mit dem Unterschied, dass die Grundformen mit einem kleineren Schlagstein aus weichem Gestein (z.B. aus Kalkstein) geschlagen wurden.

Die Tatsache, dass in Seeth-Ekholm LA 8 sowohl typische Elemente spätglazialer Traditionen (Stielspitzen, Federmesser) als auch solche des Mesolithikums (Kernbeile, Dreiecksmikrolithen) gefunden wurden, spricht zunächst dafür, dass das Ensemble inhomogen ist. Allerdings sind Kernbeile und Dreikanter, einfache mikrolithische Spitzen und kleine Stielspitzen der Long Blade Industry im Norden nicht fremd (Clausen 2014; Mevel *et al.* 2019; Sørensen und Sternke 2004). Rückenretuschierte Formen und kleine geometrische Dreiecke könnten möglicherweise einen kleinen Einschlag älterer und jüngerer Siedlungsaktivitäten andeuten, wenngleich bislang offen ist, ob und wann Dreiecksmikrolithen im frühen nordischen Präboreal auftreten. Als Bestandteil des späten Präboreals sind sie in Duvensee auf einem der ältesten mesolithischen Plätze Schleswig-Holsteins bereits vertreten

(Bokelmann 2012; Bokelmann *et al.* 1981; Gross *et al.* 2021). Aufgrund der Vergesellschaftung der Kern- und Klingengeräte mit den überwiegend einfachen Spitzen sowie unter Berücksichtigung des Klingenkonzeptes dürfte das Inventar in die Übergangsphase von der Ahrensburger zur Maglemose-Kultur und nicht in die Federmessergruppen zu stellen sein (im Unterschied dazu: Grimm und Detjens 2023). Zusammen mit knapp einem Dutzend weiterer Fundstellen ist der LBI-Technokomplex in Schleswig-Holstein voll etabliert, allerdings fehlen ausgegrabene Lokalitäten, die mittels absoluter Daten einen späteiszeitlichen oder frühholozänen Zeitansatz plausibel machen. Die ¹⁴C-Datierungen in Stellmoor und Nahe zeigen jedoch (Grimm *et al.* 2020; Krüger 2020), dass die Ahrensburger Kultur in Schleswig-Holstein bis zur Präborealen Oszillation und damit noch bis ins Frühholozän reichte.

ZWISCHEN JÜNGERER RÖMISCHER KAISERZEIT UND FRÜHER WIKINGERZEIT – KLIMAWANDEL, ABWANDERUNG UND FEHLENDE RESILIENZ?

Die Jahrhunderte zwischen dem Ende des 5. Jhs. und dem Beginn des 9. Jhs. n. Chr. und damit *ca.* 300 Jahre sind eine jener Epochen, die in Schleswig-Holstein sowohl in der materiellen Kultur als auch in relevanten Siedlungsspuren und Gräberfeldern nur schwer zu fassen scheinen (zuletzt zusammenfassend Lemm *et al.* 2020; 2024). Dieser Tatsache war sich die ältere Forschung durchaus bewusst und verband dies in historischen Interpretationsmodellen auch mit überregionalen Migrationsbewegungen (dazu kritisch bereits Tischler 1954, 184–185). Heute kann die Situation allerdings differenzierter betrachtet werden. Fakt bleibt aber auch weiterhin, dass die materielle Kultur der Jahre zwischen 500 und 800 n. Chr. merklich ausdünnt und dass um 700 n. Chr. nur noch ein dünner Fundschleier erkennbar ist. So fehlen auch nach fast zwei Jahrzehnten des Einsatzes von Metalldetektoren durch ehrenamtliche Detektorgänger beispielsweise Goldblechfiguren (Guldgubber) oder Neufunde von Brakteaten, die zumindest gelegentlich im nördlichen Landesteil zu erwarten wären (siehe Pesch und Helmbrecht 2019). Eine neue Dimension erhielt die Diskussion jedoch durch den sicheren Nachweis einer markanten und abrupten Klimaveränderung infolge mehrere tropischer Megausbrüche von Vulkanen um das Jahr 536 n. Chr., die in der Fachliteratur als Late Antique Little Ice Age (LALIA) bezeichnet wird (umfassend für die Situation in Norddeutschland: Hepp 2022; hier Abb. 10). Dieser Event fällt dabei in eine Periode globaler Klimaverschlechterung (Migration Era Pessimism, MEP), die in die Jahre zwischen *ca.* 400 und 770 n. Chr. datiert werden kann (Hepp 2022, Abb. 6). Dabei korrelieren die reduzierten bzw. fehlenden Siedlungsaktivitäten in

Schleswig-Holstein deutlich mit den sich verschlechternden Klimabedingungen, was sowohl im archäologischen Befund als auch in den Bohrkernen aus schleswig-holsteinischen Seen pollenanalytisch nachweisbar ist (zusammenfassend Wiethold und Lütjens 2001). Ob diese damit auch in Schleswig-Holstein zum Ausbruch der Justinianischen Pest geführt haben könnten (Feldman *et al.* 2016), ist nicht ausgeschlossen, beim derzeitigen Forschungsstand aber auch nicht nachweisbar. Werden diese Komponenten zusammengefügt entsteht das Bild einer — aus welchen Gründen auch immer — nur bedingt resilienten Bevölkerung, die in der Mitte des 6. Jhs. n. Chr. offensichtlich unter erheblichem Druck stand.

Betrachten wir vor diesem Hintergrund nun die materielle Kultur der Jahre zwischen 500 und 800 n. Chr. etwas näher. Eine besonders aussagefähige Fundgruppe sind völkerwanderungszeitliche Fibeln, die sowohl aus Grabzusammenhängen als auch als Detektorfunde vorliegen. Bei den kreuzförmigen Fibeln, einer Leitform für das frühe 5. bis zur Mitte des 6. Jhs, stabilisiert sich das bereits bekannte Verbreitungsbild besonders im südöstlichen Holstein (Schuster 2016, 40–45 Abb. 50–53). Sie führen mit ihren jüngsten Formen bis in die Mitte des 6. Jahrhunderts und können somit als Belege für eine wenn auch ausgedünnte Siedlungsaktivität bis in das mittlere Drittel dieses Jahrhunderts interpretiert werden. In diesen zeitlich relativ jungen Horizont sind auch die wenigen Bügelfibeln und deren Derivate zu datieren, die — ebenfalls im südöstlichen Schleswig-Holstein — bis in die Zeit um 500 n. Chr. oder kurz danach zu datieren sind. Den Endpunkt dieses Fibelhorizontes könnte die Möllner

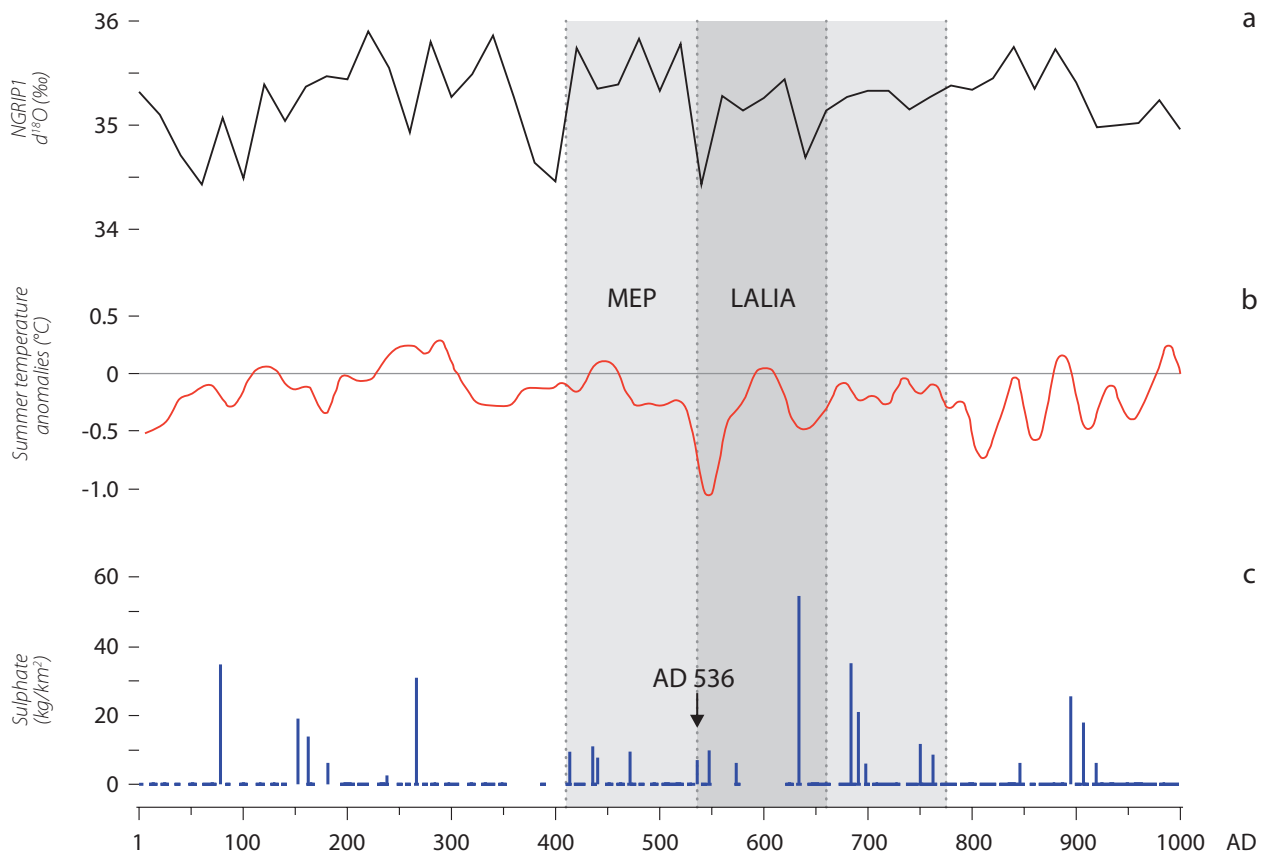


Abb. 10. Klimavariation und vulkanische Aktivitäten während des MEP/Lalia (Migration Era Pessimum/Late Antique Little Ice Age) aus nordgrönländischen Eiskernen (North Greenland Ice Core Project [NGRIP]); nach Hepp 2022; Abb. 1.; Nachdruck mit freundlicher Genehmigung von Daniel A. Hepp).

Fibel vom Typ Straß darstellen, die in die Mitte des 6. Jhs. datiert (Schuster 2016, 52 Abb. 60). Entsprechende Fibeln werden aufgrund individueller Mobilität in den Norden gelangt sein, wobei die wenigen Funde auf einige wenige Einzelereignisse und nicht auf eine strukturelle Einbindung in merowingerzeitliche Netzwerke verweisen.

Für den Norden des Landes Schleswig-Holstein entsteht dagegen in den letzten Jahren ein etwas anders Bild. Schlaglichtartig belegen die Untersuchungen von Thorsten Lemm im Umfeld der Angelner Siedlung von Husby (Kr. Schleswig-Flensburg), dass hier mit einer anderen Entwicklung zu rechnen sein wird. Detektorfunde von drei Rechteckfibeln aus Husby aus der zweiten Hälfte des 7. Jhs. oder der Zeit um 700 n. Chr. bleiben derzeit ohne weitere Vergleichsstücke im nördlichen Schleswig-Holstein (Lemm 2014, 378–79 Abb. 6; hier Abb. 11; umfassend mit Berücksichtigung der wenn auch spärlichen schriftlichen Überlieferung Lemm 2024). Sie verbinden die Region um Husby mit frühen skandinavischen Zentralplätzen wie Stavnsager in Jütland, die ebenfalls aus Detektorbegehungen bekannt geworden sind (Høilund Nielsen und Loveluck 2009).

Es kann angenommen werden, dass der Fundhorizont der Jahre 700 eine wichtige Rolle bei der Genese des wikingerezeitlichen Husby spielte und zumindest in dieser Region von einer gesellschaftlichen bzw. sozialen Kontinuität ausgegangen werden kann, selbst wenn sich dies im konkreten Fundmaterial nicht widerspiegelt (Lemm 2014, 382). Ein entsprechendes Bild zeichnen überraschenderweise die frühen Fibeln des Fundplatzes Füsing (Kr. Schleswig-Flensburg) an der inneren Schlei, die — unter deutlichen skandinavischen und kontinentalen Bezügen — in das 7. Jh. zurückreichen (Dobat, 2010: 153–154 Taf. 1–2). Die ältesten Fibelfunde desselben Zeithorizonts aus dem südöstlichen Schleswig-Holstein konnten in der Oldenburg (Kr. Ostholstein) geborgen werden, hier allerdings aus deutlich jüngeren Fundsichten (Gabriel 1991, 263–267 Abb. 9–10). Es ist bemerkenswert, dass sich die Fibelfunde des 7. Jhs. mit späteren Herrschaftszentren wie Husby oder Starigard/Oldenburg in Verbindung bringen lassen. Hier muss jedoch die weitere Entwicklung bei der Identifikation zeitgleicher Plätze abgewartet werden, da auch weiterhin geschlossene Grabfunde dieses Zeitabschnittes vollständig fehlen.



Abb. 11. Fundmaterial der 2. Hälfte des 7. Jhs. bzw. der Zeit um ca. 700 n. Chr. aus Husby, Kr. Schleswig-Flensburg (nach Lemm 2014, 379 Abb. 6 (Fotos: Museum für Archäologie, Stiftung Schleswig-Holsteinische Landesmuseen Schloss Gottorf; Zeichnungen: Gerd Hagel-Bischof).

Somit sind wir hier mit einer evidenten Quellenproblematik konfrontiert, die derzeit eine abschließende Bewertung kaum zulässt.

Ähnliche Brüche wie in der materiellen Kultur der Fibeln sind in der Entwicklung der Siedlungen des 5. bis 8. Jhs. in Schleswig-Holstein erkennbar. Für das 5. Jh. n. Chr. hat sich das Bild zumindest in einigen Kleinregionen verdichtet. Siedlungen wie jene von Flintbek (Kr. Rendsburg-Eckernförde) und Wittenborn (Kr. Segeberg) in Holstein oder Taarstedt (Kr. Schleswig-Flensburg) in Angeln belegen durchaus beeindruckende Siedlungsgefüge mit Langhäusern, Brunnen und Zäunen (Wittenborn: Lütjens 2020; Flintbek: Müller 2022; Taarstedt: Klooß 2022, bes. 74; hierzu zusammenfassend jüngst: Lütjens *et al.* 2024). Dagegen fällt das 6. Jh. weitgehend aus; erst um 600 n. Chr. verdichtet sich das Siedlungsbild schrittweise und in gewisser Weise zögerlich. Schwerpunkte bildeten sich dabei einerseits an der Westküste Schleswig-Holsteins, beispielsweise mit den Siedlungen von Witsum auf Föhr (Kr. Nordfriesland) oder dem in die Zeit um 600 datierten Strandmarkt von Amrum (Föhr, Kr. Nordfriesland: Majchczack 2020; Amrum: Segschneider 2020). Erst in der Zeit um 700 verändert sich das Siedlungsbild im östlichen Schleswig-Holstein.

Einen wichtigen Einblick in dieses 8. Jh. n. Chr. gewähren frühslawische Funde aus dem südöstlichen Holstein mit dem Burgwall von Starigard/Oldenburg als Zentralort, dessen Burgphasen I und II in das 8. Jh. datiert werden können. Hier ist es die frühslawische Keramik vom Typ Sukow und Feldberg, die einen ersten Fixpunkt für die materielle Kultur definieren (Gabriel und Kempke 1991, 123–148 Abb. 15). Diese Entwicklung kann mit der Einwanderung slawischer

Bevölkerungsgruppen in das wohl weitgehend siedlungsfreie Holstein seit der Zeit um oder bald nach 700 in Verbindung gebracht werden, die damit eine Entwicklung einleiten, die sich bis weit in das Mittelalter verfolgen lässt. Darauf lassen auch die ältesten Dendrodaten mit slawischem Kulturhintergrund in Schleswig-Holstein schließen, die vom Klempauer Moor (Bohlenweg; Kr. Herzogtum Lauenburg), Bosau (Slawendorf; Kr. Plön), Scharstorf (Burg; Kr. Ostholstein) und Alt Lübeck (Burg; Hansestadt Lübeck) stammen (Dulinicz 2006, 43–51).

In den Bereich der siedlungsanzeigenden Funde gehört auch der Muschelhaufen aus Eckernförde (Stadt; LA 56, Kr. Rendsburg-Eckernförde (Offermann 2018; hier Abb. 12). Das Material dieser Fundstelle befand sich lange unbeachtet und damit unbearbeitet in den Magazinen des Museums für Archäologie auf Schloss Gottorf. Die Auswertung und Datierung des Materials zeigt, dass hier neben anderen Molluskenarten Miesmuscheln (*Mytilus edulis*), Herzmuscheln (*Cardium edule*) und Austern (*Ostrea edulis*) deponiert worden waren. Die ¹⁴C-Daten belegen die Entstehung umfangreicherer Schalenpakete ab dem 7. Jh., teilweise auch davor. Damit ist eine Ressourcennutzung fassbar, die für den in Frage stehenden Zeitraum zwischen dem 400 und 800 n. Chr. bislang unbekannt war.

Von übergeordneter Bedeutung für die archäologische und historische Landesgeschichte Schleswig-Holsteins und darüber hinaus ist das Danewerk. Es zieht sich als deutlich erkennbarer Wallzug über die Schleswiger Landenge und bindet mit dem Osterwall die Abriegelung der Schwansen Halbinsel und mit dem Seesperrwerk bei Reesholm (Kr. Schleswig-Flensburg) die Sicherung des Überganges von Schwansen nach

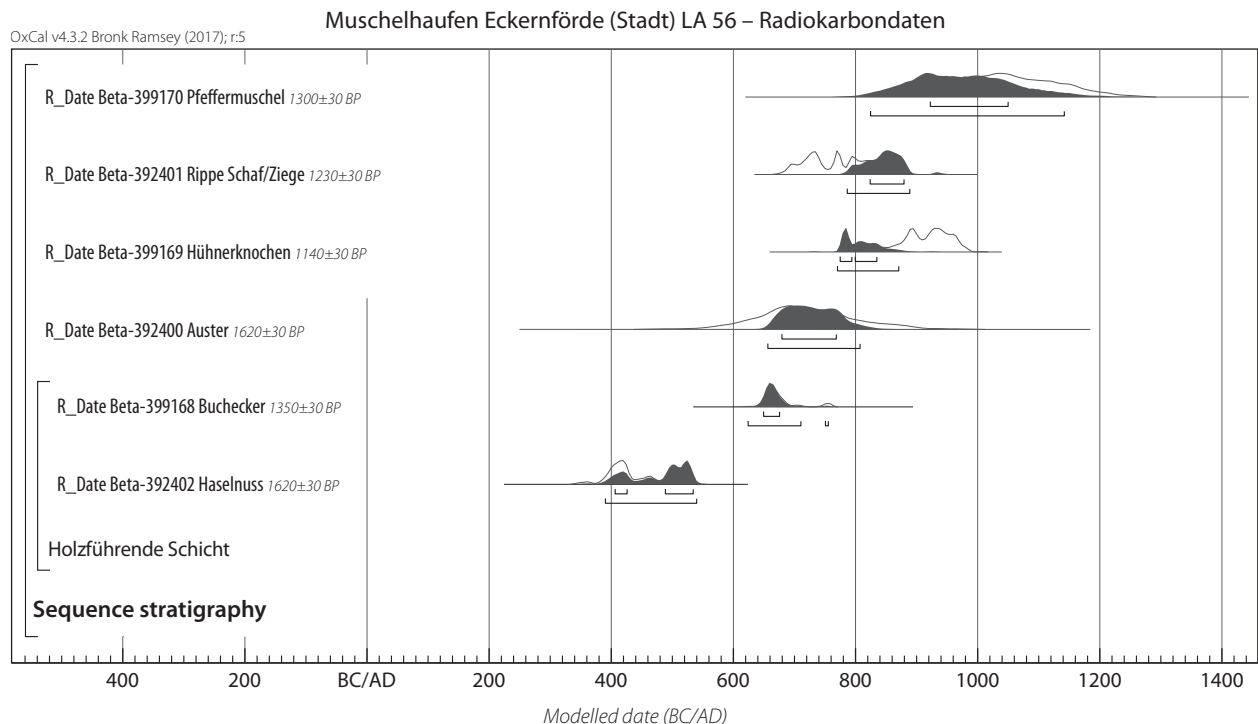


Abb. 12. ^{14}C -Datierungen des Muschelhaufens auf dem Stadtgebiet von Eckernförde (nach Offermann 2018, 75 Abb. 27).

Angeln mit in das strategische Konzept ein. Schon länger in der Forschung diskutiert sind die relativ frühen Daten für die Feldsteinmauer, die allgemein in das 8. Jh. n. Chr. datiert wird, wie auch die Dendrodaten für das Seesperrwerk und Teile des Nordwalles, die in die 730er Jahre datieren (Dobat 2009, 141–142). Außergewöhnlich und unerwartet sind nun die neuen ^{14}C -Daten, die die Ausgräberinnen Frauke Witte und Astrid Tummuscheit während ihrer Grabung am Danewerk-Tor in der Gemeinde Dannewerk im Kreis Schleswig-Flensburg gewinnen konnten (Tummuscheit und Witte 2014, siehe auch Tummuscheit und v. Carnap-Bornheim 2019). Sie belegen Wallphasen bereits im 5. bzw. 6. nachchristlichen Jh., womit die Geschichte des Bauwerkes deutlich verlängert wurde, so wie es Ole Harck bereits 1998 in seinem Aufsatz zum Primärwall des Danewerkes postulierte. Für unseren

Zusammenhang ist dies von besonderer Bedeutung, ist doch der Bau und der Unterhalt eines solchen Großbauwerkes nur unter gesicherten politischen und sozialen Verhältnissen denkbar, die sich so allerdings in anderem archäologischen Fundstoff kaum oder nur sehr wenig abzeichnen, was Thorsten Lemm treffend als „*The Danewirke-settlement gap contradiction*“ bezeichnet (siehe auch Lemm 2024, 67–72). Allenfalls die von Thorsten Lemm publizierten Doppelgrabanlagen aus Heiligenstedten, Kr. Steinburg und Aukrug, Kr. Rendsburg-Eckernförde können mit unterschiedlicher Sicherheit mit dem Danewerk im 7. Jh. parallelisiert werden (Lemm 2020). Zudem wird um das Danewerk zusammen mit weiteren Burgwallanlagen in den südlichen Landesteilen um 700 n. Chr. jene territoriale Gliederung sichtbar, die ab dem 9. Jh. die archäologisch und historische belegte Landesgeschichte bestimmt.

ZUSAMMENFASSUNG

Mit unserem Beitrag diskutieren wir prägnante Lücken in der archäologischen Landesgeschichte Schleswig-Holsteins, die als *Dark Ages* bezeichnet werden könnten und die grundsätzliche methodische Fragen provozieren. Dabei ist zunächst zu klären, ob diese Lücken und die damit verbundene Fundleere durch die Zerstörung entsprechender Befunde ausgelöst wurden

oder ob die archäologische Quellenlage die Identifikation entsprechender Siedlungsmuster grundsätzlich erschwert oder gar verhindert. Letztlich müssen aber auch strategische Defizite bzw. ungünstige gesetzliche Rahmenbedingungen in der archäologischen Denkmalpflege für diese Fehlstellen in Betracht gezogen werden.

Mit unserem Beitrag wird deutlich, dass die hier analysierten Fundlücken unterschiedlicher Natur sind und sie — im Fall der ersten beiden Lücken — unter Anwendung traditioneller Methoden überzeugend geschlossen werden können. Dabei kommt den von Sammlern zusammengestellten Inventaren eine ganz besondere Bedeutung zu. Ihren Wert erhalten sie durch die profunde Materialkenntnis der Sammler, ihre übergeordnete wissenschaftliche Relevanz durch fach- und sachkundige Analyse und Vergleich. Denn vielfach lösen diese Sammlungen weiterführende interdisziplinären Forschungen aus, die wichtige Einblicke in die archäologische Landesgeschichte erlauben. Als ein Ergebnis muss hierbei festgehalten werden, dass die Anwesenheit von Neandertaler-Gruppen nördlich der Elbe im späten Mittelpaläolithikum sicher nachgewiesen ist. Für den Übergang vom Spätglazial zum Frühholozän um 9600 v. Chr. kann über den Nachweis von Long Blade Industries (LBI) belegt werden, dass die späteiszeitlichen Jägergruppen in

einer sich grundsätzlich verändernden Umwelt nachhaltige Überlebensstrategien entwickelten.

Anders stellt sich die Situation in unserem dritten Fallbeispiel dar. Hier sind es veränderte denkmalrechtliche Grundvoraussetzungen zur Umsetzung des Verursacherprinzips und des kooperativen Modells in der Zusammenarbeit mit Detektorgängern und -gängerinnen, die das bislang nur in Schemen erkennbare Bild der Besiedlung Schleswig-Holsteins zwischen den Jahren 500 und 800 n. Chr. wesentlich erweitert haben. Dazu tragen einerseits die bessere Kenntnis von Siedlungsgefügen und der durch Metallfunde wesentlich verdichtete Fundanfall bei. In Verbindung mit aktuellen naturwissenschaftlichen Daten und neuen Ausgrabungen entsteht so das Bild einer tiefen Krise, die um die Mitte des 6. Jhs. n. Chr. zu einem erheblichen und über Jahrzehnte spürbaren Bevölkerungsrückgang führte. Ab 700 n. Chr. wird aber auch jene territoriale Gliederung sichtbar, die das Frühmittelalter Schleswig-Holsteins ab dem 9. Jh. prägte.

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